DEVELOPMENT TEST PLAN (DESIGN) DYNA-SOAR

T. J. Cronin

Boeing Company
Seattle, Washington

13 December 1960

[redacted]

BOEING AIRPLANE COMPANY

SEATTLE 24, WASHINGTON

AD 756851

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REVISED

July 20, 1961: Revised to delete D2-6783-1 as Volume III of D2-5697-16. Pages affected are; iii, IV, V, VII, IX, X, 106, and 347. Revised title page to add note clarifying change in classification.

Prepared By: H. D. Setterberg 7/25/61

Approved By: L. A. Binegar

SEPT.11 , 1961: Completely revised document to condense Test Briefs and update to reflect current planning.

Prepared By: Design Development and Qualification Test Requirements Group.

H. D. Setterberg

Approved: for L. A. Binegar

Dec. 29, 1961 Document changed to reflect current planning.

Prepared By: R. H. Rasmussen
R. H. Rasmussen

Supervised By: H. D. Setterberg
H. D. Setterberg

Approved By: L. A. Binegar
L. A. Binegar

REVISED 3-29-62

REVISION

February 26, 1962 — Document updated to reflect latest planning and support EWA release.

Prepared By: R. H. Rasmussen

Supervised By: H. D. Setterberg

Approved By: for L. A. Binegar

March 29, 1962 — This volume has been completely reviewed and revised to reflect current status.

Prepared By: R. H. Rasmussen

Supervised By: H. D. Setterberg

Approved By: for L. A. Binegar

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REFERENCES

Military Specifications

MIL-D-9412C-2 (As amended by the Statement of Work)	Data for Ground Support of Weapon Systems, Support Systems, Subsystems, and Equipment
Exhibit 620A-62-2	Statement of Work, System 620A, Dyna-Soar Exhibit 620A-62-2, dated 26 January 1962

BAC Documents

D2-6783-1	Structural Integrity Development and Test Program - Detail Plan - Structures Technology

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10-20914	Skid Assembly, Main Landing Gear
10-20921	Skid Assembly, Nose Landing Gear

INTRODUCTION

The development test plan for Dyna-Soar (Step I) program is contained in Document D2-5697-16 which is composed of four volumes:

Volume II Development Test Plan - Design

Volume IV Development Test Plan - Qualification
(Not released to the Air Force)

Volume V Development Test Plan - Acceptance (Functional)

Volume VI Development Test Plan - Design Integration

Volume II, "Development Test Plan - Design" is submitted in compliance with paragraph 3(1)k of the Statement of Work, System 464L, Dyna Soar (Step I), Exhibit 21A-62-2, dated 26 January 1962.

Test Brief Numbering

Briefs for tests to be conducted by Boeing are numbered in sequence within each numbered section. The numbered sections are basically consistent with the Dyna-Soar Program Elements.

Subcontractor test briefs follow in each section and are numbered S1, S2, etc. Other agency tests will follow subcontractor tests and will bear appropriate prefix letters. They will also be numbered in sequence within each numbered section of the document (i.e., NASA 1, NASA 2, etc.).

Associate Contractor plans are not within the scope of this document.

Note: It is anticipated that changes in the planning schedules shown in this document will have negligible effect on program milestones. When the document is revised for reasons of significant changes to the scope or technical approaches to Dyna-Soar testing, the planning schedules will be updated as a part of such revisions. Also, all Engineering Work Authorization (EWA) numbers shown in Test Briefs are for reference purposes of The Boeing Company and are not a part of this document.

1.1.1.1 GLIDER AIRFRAME - AERO - DYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-1 Responsible Company: Boeing

Test Title: VARIATIONS AROUND PHASE I CONFIGURATION (COMPLETED)

Test Objective/Justification: The following tests were conducted to determine the performance and longitudinal and lateral-directional stability and control characteristics of the Phase I glider configuration, and variations thereof, in the subsonic, transonic, supersonic and hypersonic speed regimes.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
78	May 60	7-007	AD-366I-4	Boeing Supersonic	D2-6721
79	Sep 60	7-043	AD-366I-5	Langley 16'	D2-8146
80	Nov 60	7-012	AD-482I-1	JPL 21"	D2-7901 D2-80058 D2-80098
81	Sep 60	7-033	AD-490I-1	Arnold B	D2-8016
82	Sep 60	7-008	AD-473I-1	Cornell 24"	D2-80004
83	Nov 60	7-051	AD-473I-3	Cornell 24"	D2-80016
83	Nov 60	7-052	AD-473P-1	Corenll 24"	D2-80022
85	Oct 60	7-036	AD-488I-1	Ames 12' PT	D2-8089
86	Nov 60	7-035	AD-493I-1	Langley 11"	D2-8160
87	Canceled (Nov 60)	7-009	AD-469I-1	Ohio State 12"	D2-80291
88	Nov 60	7-056	AD-520M-1	Gen. Elec. 30"	D2-80032
89	May 61	7-059	AD-522I-1 AD-553I-1	Boeing Hot Shot	D2-80060
90	Dec 60	7-063	AD-366I-6	Boeing Transonic	D2-8142
90	Nov 60	7-063	AD-366I-6	Boeing Supersonic	D2-8116
91	Nov 60	7-061	AD-488I-2	Boeing Transonic	D2-8038

COMPLETED DATES AS NOTED

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

RFD 3-29-61

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-2 Responsible Company: Boeing

Test Title: VARIATIONS AROUND INITIAL GLIDER CONFIGURATION (COMPLETED)

Test Objective/Justification: The following tests were conducted to examine the performance and longitudinal and lateral-directional stability and control characteristics of the initial glider configuration, and variations thereof, in the subsonic, transonic, supersonic and hypersonic speed regimes.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
92	Jan 61	7-074	AD-544I-1	Boeing Transonic	D2-8225
93	Feb 61	7-066	AD-543I-1	Boeing Transonic	D2-80025
94	Jan 61	7-066	AD-543I-1	Boeing Supersonic	D2-80005
95	Feb 61	7-073	AD-540I-1	Arnold B	D2-80006
96	Feb 61	7-064	AD-539I-1	JPL 21"	D2-80031
97	Feb 61	7-065	AD-541I-1	Langley 11"	
99	APR 61	7-069	AD-542I-1	Boeing Hot Shot	D2-80296
133	May 61	7-081	AD-543I-2	Boeing Transonic	D2-80026
133	Apr 61	7-081	AD-543I-2	Boeing Transonic	D2-80298
133	Apr 61	7-081	AD-543I-2	Boeing Supersonic	D2-80099
152	Mar 61	7-074	AD-544I-2	Ames 12' PT	D2-80072

COMPLETED
DATES AS NOTED

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

REV 3-9-61

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-3 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #102)

Test Objective/Justification: The objective of this test is to obtain data on the effects of elevon, aileron and rudder in various combinations, Reynolds number, Mach number, landing gear, on basic glider longitudinal, lateral and directional stability during landing. Directional stability of angles-of-attack of at least 15-degrees is also desired during this test period.

Test Articles/Outline: An 0.15 scale model corresponding to approximately the current Dyna-Soar glider configuration will be tested at the following conditions:

1. Mach number range: 0.26 to 0.90
2. Reynolds number range: 5×10^6 to 24×10^6/ft
3. Pitch range: $\alpha = -10^\circ$ to 22°
4. Yaw range: $\psi = -15^\circ$ to 15°

Test Facilities: Ames 12 ft Pressure Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-085

This Test Supports - The glider and transition section configuration development

Date Data Req'd: 4-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

FORM 2-6181-1-1
5-29-2 REV

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-4 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #103)

Test Objective/Justification: The objective of this test is to obtain performance, stability and control data concurrently with elevon, elevon tab and rudder hinge moment and normal force data.

COMPLETED
2-26-62

Test Articles/Outline: An 0.0666 scale model of the current Dyna-Soar glider configuration with a detachable transition section will be tested at the following conditions:

1. Mach number range: 0.5 to 1.15
2. Pitch range: α = 15° to 25°
3. Yaw range: ψ = -15° to 15°

Test Facilities: Boeing Transonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-086

This Test Supports - The glider and transition section configuration Development

Date Data Req'd: 3-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-5 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #104)

Test Objective/Justification: The objective of this test is to obtain performance, stability and control data concurrently with elevon, elevon tab and rudder hinge moment and normal force data.

Test Articles/Outline: An 0.0666 scale model of the current Dyna-Soar glider configuration with a detachable transition section will be tested at the following conditions:

1. Mach number range: 1.4 to 3.5
2. Pitch range: $\alpha = 10^{o}$ to 35^{o}
3. Yaw range: $\psi = -15^{o}$ to 15^{o}

Test Facilities: Boeing Supersonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-086

This Test Supports - The glider and transition section configuration development

Date Data Req'd: 5-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

FORM 2-6181-1-1

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-6 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #105)

Test Objective/Justification: The objective of this test is to obtain supersonic performance and longitudinal, lateral and directional stability and control data on a structurally deformed (hot shape) model of the current Dyna-Soar glider configuration.

COMPLETED
1-24-62

Test Articles/Outline: An 0.054 scale model of the current Dyna-Soar glider configuration, including the effects of structural deformation will be tested at the following conditions:

1. Mach number: 5.00
2. Pitch range: -15° to max
3. Yaw range: ± 10°

Test Facilities: Arnold Center "A" Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-087

This Test Supports - development: The glider and transition section configuration

Date Data Req'd: 3-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-7 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #106)

Test Objective/Justification: The objective of this test is to obtain hypersonic performance, stability and control data on a structurally deformed (hot shape) model of the current Dyna-Soar glider configuration.

This test will permit a more detailed analysis of elevon, aileron and rudder effectiveness as well as the effect of transition section on glider stability and control surface effectiveness.

COMPLETED
2-9-62

Test Articles/Outline: An 0.054 scale model of the current Dyna-Soar glider configuration including the effects of structural deformation will be tested at the following conditions:

1. Mach number: 8.08
2. Pitch range: -15° to 60°
3. Yaw range: -10° to 10°

Test Facilities: Arnold Center "B" Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-087

This Test Supports - The glider and transition section configuration development

Date Data Req'd: 3-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-8 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #108)

Test Objective/Justification: The objective of this test is to obtain hypersonic performance and longitudinal, lateral and directional stability and control data on a structurally deformed (hot shape) model of the current Dyna-Soar glider configuration.

This test will extend the data obtained in the preceding brief to a higher Mach number.

COMPLETED
2-21-62

Test Articles/Outline: An 0.054 scale model of the current Dyna-Soar glider configuration including the effects of structural deformation will be tested at the following conditions:

1. Mach number: 10.0
2. Pitch range: -15° to 60°
3. Yaw range: -10° to 10°

Test Facilities: Arnold Center "C" Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-087

This Test Supports - The glider and transition section configuration development

Date Data Req'd: 3-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-9 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION (COMPLETED)

Test Objective/Justification: This test was conducted to examine the performance, longitudinal stability, and lateral-directional stability characteristics of the current Dyna-Soar glider configuration. The test was conducted using a structurally deformed (hot shape) model. A complete range of deflections for all control surfaces were run including both elevons and both rudders (inboard and outboard). Effect of Reynolds number was also investigated.

SPO APPROVED TEST NO.	COMPL. DATE	EWA (REF)	MODEL #	FACILITY	DATA REPORT
107	Sep 61	7-088	AD 598I-1	JPL 21"	( )

Test Articles/Outline:

COMPLETED 9-61

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERO DYNAMIC DEVELOPMENT - Performance Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-10 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #112)

Test Objective/Justification: The objective of this test is to determine performance, longitudinal and lateral-directional stability and control characteristics of a structurally deformed (hot shape) configuration of the Dyna-Soar glider in a hypersonic flow regime. The effects of the transition section and control surface effectiveness (elevons and rudders) will be determined. The maximum and minimum Reynolds number capability of the test facility will be utilized to determine Reynolds number effect and to aid in the extrapolation of test data to flight conditions.

COMPLETED 2-16-62

Test Articles/Outline: An 0.0400 scale model of the Dyna-Soar glider with heat shield and including the effects of structural deformation will be tested, with and without the transition section, at the following conditions:

1. Mach number: 14, 16, 19 and 22
2. Pitch range: -10° to 60°
3. Yaw range: 0° to 10°

Test Facilities: Boeing Hot Shot Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-090

This Test Supports - The glider and transition section configuration development

Date Data Req'd: 4-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-11 Responsible Company: Boeing

Test Title: GLIDER ROTARY DERIVATIVE
(SPO APPROVED TESTS #116 & 117)

Test Objective/Justification: Precise definition of the rotary derivatives of the Dyna-Soar glider is difficult by analytical methods. Experimental data for these derivatives is required through the transonic speed range of the vehicle.

Test Articles/Outline: Tests utilizing models of the final glider configuration are planned for the following facilities and in the listed speed ranges. Both longitudinal and lateral-directional derivatives will be obtained. These data will provide the final inputs for simulation studies and for determining glider handling characteristics.

Test Facilities: and Mach Number: Ames 12' Pressure Tunnel, 0.26; Ames Unitary-Transonic, 0.5 to 1.4

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-091

This Test Supports - The glider performance development

Date Data Req'd: 3-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-12 Responsible Company: Boeing

Test Title: GLIDER STATIC AEROELASTIC TESTS (SPO APPROVED TESTS #120, 121)

Test Objective/Justification: These tests are to provide data on the effect of aeroelastic derlections of the glider on stability and control characteristics. This data is to be obtained on force-balance models which have the same structural rigidity, with respect to the tunnel testing airflow conditions, as the full scale glider in flight. This data is to be compared with that obtained on the conventional rigid wind tunnel models covered in test briefs 1, 2, and 3 of this section.

(122 and 123 are cancelled)

Test Articles/Outline: A model which is scaled to the Dyna-Soar glider in stiffness as well as contour will be fabricated and tested. The data will be used to confirm the predicted effect on the glider handling qualities.

Test Facilities: Ames Research Center Unitary 11' x 11' and Arnold Center 16' Propulsion Wind Tunnel--Supersonic Leg

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-092

This Test Supports - Verification of Glider Handling Qualities

Date Data Req'd: 3-1-63

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-13 Responsible Company: Boeing

Test Title: GLIDER - TRANSITION SEPARATION TESTS
(BPO APPROVED TEST #126)

Test Objective/Justification: Experimental wind tunnel data will be obtained on the performance, stability and control characteristics of glider to second stage transition in the vicinity of the glider. The test will simulate the conditions of the transition separation.

Test Articles/Outline: Two test periods are shown for the glider-transition separation tests. These tests will cover a speed range from M = 0 to 3.5. This performance, stability and control data will be taken at angles-of-attack ranging from -10° to +20°. and yaw angles up to 8°. These cover the anticipated separation conditions.

A special six component balance will be required for these tests. The transition must be supported on a balance independently from the glider model. No glider loads may be recorded by this balance.

Test Facilities: Boeing Transonic Wind Tunnel, Boeing Supersonic Wind Tunnel, Arnold Center "B" Tunnel, Arnold Center "A" Tunnel.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-093

This Test Supports -

Date Data Req'd: 8-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-14 Responsible Company: Boeing

Test Title: AIR DATA SYSTEM DEVELOPMENT
(SPO APPROVED TESTS #147 & 148)

Test Objective/Justification: The objective of this test is to determine satisfactory locations for the air data system pressure pickups for the Dyna-Soar glider.

Test Articles/Outline: The model will be an 0.0666 scale model of the Dyna-Soar glider with the control surfaces at 0° incidence. The model will be equipped with a movable impact pressure rake (3 tubes) and single impact tubes to measure the impact pressure at various locations on the model. Pitot-static booms will be provided for testing on the nose and vertical tail fins. There will also be 15 static orfices on the surface of the fuselage in the nose region and in the vicinity of the cockpit. The model will be tested at the following conditions:

1. Mach number range: 0.5 to 3.5
2. Pitch range: -5° to 20°
3. Yaw range: -10° to 10°

Test Facilities: Boeing Transonic Wind Tunnel and Boeing Supersonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-100 & 7-121

This Test Supports - The glider air data system design

Date Data Req'd: 7-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-15 Responsible Company: Boeing

Test Title: GLIDER - B-52 COMPATIBILITY - WIND TUNNEL MODEL TESTS
(SPO APPROVED TESTS #124 & 125)

Test Objective/Justification: Experimental data will be obtained on the performance, stability and control characteristics of the B-52 including the glider. Data will also be obtained on the glider along during separation. Satisfactory methods of separation will be determined. Problem areas found during test or by prior analysis will be tested and corrected during these tests.

Test Articles/Outline: Two periods are shown for the glider - B-52 compatibility tests. During the initial period data will be obtained on the glider - B-52 combination to determine any adverse effects on the carrier's performance, stability and control. These tests will be performed from low speed through launch speed. During the second period, drop tests of dynamically similar models of the glider will be made to determine satisfactory separation condition.

Test Facilities: University of Washington Low Speed Wing Tunnel and Boeing

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-132 & Wichita P.O. _____.

This Test Supports - _____

_____ Date Data Req'd: 4-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1 REV 2-29-2

1.1.1.1 GLIDER AIRFRAME- AERO-DYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-16 Responsible Company: Boeing

Test Title: "FIXED-CONFIGURATION" EVALUATION
(SPO APPROVED TEST #111)

Test Objective/Justification: This test will obtain hypersonic performance, stability and control data on the structurally deformed (hot shape) model of the current Dyna-Soar glider configuration. This data will be obtained under continuous flow conditions in helium which will be used to supplement the intermittent flow hot shot data.

CANCELLED

Test Articles/Outline: An .0309 scale model of the modified 844-2050 design including the effects of structural thermal distortion will be tested at the following conditions:

1. M = 14, 24
2. Pitch range -5° to +20°
3. Yaw range +5° to -5°

This will be the same model which will be used in the test of test brief number 1-9.

Test Facilities: Langley Research Center 20" Helium Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - Glider configuration development

Date Data Req'd: May 62

Flow Time (EWA Rel. to Compl.) Test Period

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-17 Responsible Company: Boeing

Test Title: CONFIGURATION REFINEMENT TESTS
(SPO APPROVED 127, 128, 129, 130, 131, 132)

Test Objective/Justification: These tests, utilizing modified models from the "fixed - configuration" evaluation tests, will be used to determine the effect of small changes in configuration which might be dictated by considerations other than performance stability and control, such as heating, equipment placement, structures placement and so forth and to resolve performance, stability and control problem areas.

CANCELLED

Test Articles/Outline:

Test Facilities: Boeing Transonic Wind Tunnel, Boeing Supersonic, Arnold Center - B, Arnold Center - C, Langley 20" Helium, Boeing Hot Shot Wing Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - Configuration development of the glider and transition

Date Data Req'd: 12-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-18 Responsible Company: Boeing

Test Title: HEAT SHIELD EJECTION TESTS
(SPO APPROVED TESTS #145, 146)

Test Objective/Justification: This test will determine the forces which must be overcome to eject the wind shield heat shield and to determine that the trajectory is such that the heat shield will clear the glider when it is ejected.

Test Articles/Outline: An .0666 scale model of the 844-2050 configuration glider which will be tested under the following conditions:

1. M = .3 to 1.10
   = 1.4, 2.0, 3.5
2. Pitch range = -5° to +20°
3. Yaw range = ± 5°

Test Facilities: Boeing Transonic Wind Tunnel, Boeing Supersonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-119

This Test Supports - Data required to establish design requirements for the glider

Date Data Req'd: Aug 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Performance	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-19 Responsible Company: Boeing

Test Title: ACCELERATION ROCKET FLOW - BASE DRAG TEST
(SPO APPROVED TEST #178)

Test Objective/Justification: Obtain data the effect of the acceleration rocket flow on the glider base drag - performance.

CANCELLED

Test Articles/Outline: An .07S scale model of the 844-2050 glider and transition. A scale rocket of a gain simular in characteristics to the full scale rocket will be used. The model will be tested under the following conditions:

1. M = .50, 1.10
2. Pitch angle = 0°
3. Yaw angle = 0°

Test Facilities: Boeing Transonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-097

This Test Supports - The glider and transition section configuration development

Date Data Req'd: Sept 62

Flow Time (EWA Rel. to Compl.) ▭▭▭ Test Period ▨▨▨

1.1.1.1 GLIDER AIRFRAME - AERO-DYNAMIC DEVELOPMENT - Performance	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-20 Responsible Company: Boeing

Test Title: GLIDER BODY CAVITY VENTILATION TEST
(SPO APPROVED TEST #185)

Test Objective/Justification: To obtain data at subsonic, transonic and supersonic speeds on the air scoop required to eliminate the collection combustible APU exhaust gasses in the body cavity.

Test Articles/Outline: A scale model of the 844-2050 glider

1. M = .26 to 3.5
2. Pitch = 0 - 27°
3. Yaw = $\pm$ 10°

Test Facilities: Boeing Transonic Wind Tunnel, Boeing Supersonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
															■								

EWA(s) No. 3-428

This Test Supports - Glider Configuration Development

Date Data Req'd: 5-1-62

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭▭ Test Period ▮▮▮▮▮▮▮▮▮▮

GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - STABILITY AND CONTROL	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-21 Responsible Company: BOEING

Test Title: TEST FOR EFFECTS OF MINOR CONFIGURATION MODIFICATIONS (SPO # 190)

Test Objective/Justification:

The purpose of this test is to evaluate the effects on stability and control of several configuration changes that are being considered.such as the addition of elevon actuator housing in the wing-body joint, elevon edge trim revisions, contour revisions at the wing-vertical tail joint, etc.

Test Articles/Outline:

An existing scale model of the 844-2050D glider will be modified to include the configuration changes being considered. It will be tested at Mach Numbers from 0.5 to 3.5.

Test Facilities:

Boeing Transonic wind tunnel
Boeing Supersonic wind tunnel

Schedule:

1961												1962												1963
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J

EWA(s) No. 7-128

This Test Supports - GLIDER CONFIGURATION DEVELOPMENT

Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REVISED 1-14-63

FORM 2-6181-1-1

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-1 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING PARAMETRIC SERIES (BASIC WING TESTS) (COMPLETED)

Test Objective/Justification: These tests were conducted to accumulate heat transfer, pressure and flow field data on a series of flat delta wings of varying bluntness with cylindrical leading edges for the purpose of establishing analytical methods and design heating rates.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
1	Jun 61	7-004	AD-461M-1	Boeing Hypersonic	
2	Oct 60	7-006	AD-462M-1	Arnold B	D2-8045
3	Sep 60	7-003	AD-461P-1	Boeing Supersonic	D2-8009
4	Dec 60	7-020	AD-495M-1	Gen. Elect. 30"	D2-80032
5	Dec 60	7-037	AD-508M-1	Cornell 24"	D2-80062
6	Dec 60	7-010	AD-485M-1	Avco 4"	D2-80304

COMPLETED
DATES AS NOTED

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

FORM 2-6181-1-1

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-2 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING, PARAMETRIC SERIES (PLANFORM VARIATION TESTS) (COMPLETED)

Test Objective/Justification: These tests were conducted to obtain heat transfer pressure and flow field data on the lower surface and cylindrical leading edge of a series of delta wings having different sweep angles for the purpose of establishing analytical methods and design heating rates.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
8	Nov 60	7.021	AD-483M-1	Boeing Supersonic	D2-80049

Test Articles/Outline:

COMPLETED 11-60

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-3 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING, PARAMETRIC SERIES (LOWER SURFACE GEOMETRY) (COMPLETED)

Test Objective/Justification: These tests were conducted to obtain heat transfer and pressure data on several lower surface shapes (curved bottom, tilted profile and ventral fin) for the purpose of establishing analytical methods and design heating rates.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
10	Nov 60	7-004	AD-461M-1	Boeing Hypersonic	
11	Nov 60	7-047	AD-461P-2	Langley 11"	

Test Articles/Outline:

COMPLETED
11-60

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

FORM 2-6181-1-1
REV 3-29-2

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-4 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING, PARAMETRIC SERIES (INTERFERENCE TESTS) (COMPLETED)

Test Objective/Justification: These tests were conducted to accumulate heat transfer and pressure data on wings, bodies, fins, rudders and elevons when each is exposed to the flow field created by the others. The data are used to establish design heating rates.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (REF. ONLY)	Model	Facility	Data Report(s)
12	Nov 60	7-004	AD-461M-1	Boeing Hypersonic	
13	Oct 60	7-006	AD-462M-1	Arnold B	D2-8045

Test Articles/Outline:

COMPLETED 10-60 & 11-60

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-5 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING, STAGNATION REGION (COMPLETED)

Test Objective/Justification: These tests were conducted to obtain heat transfer, pressure distribution and flow field data on the nose stagnation region, for the purpose of establishing analytical methods and design heating rates.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
15	Aug 60	7-002	AD-463M-1	Arnold B	D2-8078
16	Dec 60	7-055	AD-514M-1	Gen. Elect.30"	D2-80032
17	Dec 60	7-049	AD-494M-1	Gen. Elect.30"	D2-80032
18	Dec 60	7-050	AD-474M-1	Boeing Hypersonic	
154	Jul 61	7-084	AD-463M-2	Boeing Hot Shot	

Test Articles/Outline:

COMPLETED
DATES AS NOTED

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-6 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING LEADING EDGES (COMPLETED)

Test Objective/Justification: These tests were conducted to obtain heat transfer and pressure distribution data along and around delta wing leading edges in support of the theory associated with these areas for the purpose of establishing analytical methods and design heating rates.

SPO APPROVAL TEST NO.	COMPLETION DATE	EWA (Ref. Only)	MODEL	FACILITY	DATA REPORT(s)
19	Oct 61	7-005	AD-465M-1	Jet Prop. Lab 21 inch	
21	Jan 61	7-045	AD-477M-1	Arnold B	D2-8206
21	Jan 61	7-045	AD-477M-1	Arnold B	D2-8221
22	Dec 60	7-037	AD-502M-1	Cornell 24"	D2-80062
23	Dec 60	7-020	AD-495M-1	Gen. Elect 30"	D2-80032

Test Articles/Outline:

COMPLETED
DATES AS NOTED

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-7 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING, REAL GAS EFFECTS (COMPLETED)

Test Objective/Justification: This test was conducted to aid in establishing reliable design methods for predicting heating rates when real gas effects are present.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	Model	Facility	Data Report(s)
24	Dec 61	7-010	AD-485M-1	Avco 4 inch	D2-80304

Test Articles/Outline:

COMPLETED
12-61

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭▭▭▭ Test Period ▨▨▨▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-8 Responsible Company: Boeing

Test Title: VISUAL HEATING DISTRIBUTION (COMPLETED)

Test Objective/Justification: This test was conducted to identify the relative distribution of heat transfer rate, using thermal paint, and obtain heating rates.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref only)	Model	Facility	Data Report(s).
27	Oct 61	7-083	AD-563M-1	Boeing Hypersonic	

Test Articles/Outline:

COMPLETED
10-61

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭▭▭ Test Period ▨▨▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-9 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING ELECTRONIC CHARACTERISTICS (SIMPLE FLOW FIELD TESTS) (TEST #25)

Test Objective/Justification: The objective of this test is to obtain electronic characteristics measurements in a simple flow field for which thermodynamic properties can be accurately predicted. This data is required to substantiate analytical estimates of the dependency of electron density on thermodynamics properties.

Test Articles/Outline: Contingent upon favorable results of a feasibility study, a simple shape model (e.g., a sharp or slightly blunted wedge) will be tested in a facility capable of achieving the correct electron density levels. The shape tested will be such that the thermodynamic properties of the field can be predicted with confidence, and will be essentially uniform. Electron density deduced from measured microwave attenuation and/or phase shift then will be correlated with the known thermodynamic properties.

CANCELLED

Test Facilities: Boeing Hot Shot Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - Glider communications system design

Date Data Req'd: 6-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3-10 Responsible Company: Boeing

Test Title: AERODYNAMIC HEATING, ELECTRONIC CHARACTERISTICS (PLASMA SHEATH TESTS) (NOT YET APPROVED BY SPO)

Test Objective/Justification: The objective of this test is to obtain electronic characteristics measurements in a flow field simulating a full scale portion of the ion sheath surrounding the Dyna-Soar glider in flight. Data collected is required to verify methods used to predict the full scale ion sheath electronic characteristics.

Test Articles/Outline: Contingent upon favorable results of a preliminary design study, tests will be conducted in a facility fitted with a specially designed expansion nozzle shaped to provide the pressure, density, temperature, enthalpy, and entropy level and the distribution predicted for a full scale portion of the ion sheath. Integrated electronic characteristics of this plasma sheath will be obtained by measurements of microwave attenuation and/or phase shift.

[redacted]

CANCELLED

[redacted]

Test Facilities: It is currently planned to perform this test in a shock tube with a modified expansion nozzle.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

(TO BE ADDED)

EWA(s) No. _____

This Test Supports - Glider communications system design

Date Data Req'd: 6-62

Flow Time (EWA Rel. to Compl.) [redacted] Test Period [redacted]

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT - Aerodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-11 Responsible Company: Boeing

Test Title: SURFACE ROUGHNESS AND DEFLECTED CONTROL HEATING RATE TESTS (SPO APPROVED TEST #159)

Test Objective/Justification: To obtain detailed heat transfer rate and pressure distributions in regions of typical types of roughness; to obtain detailed heat transfer rate and pressure distributions ahead of and on surfaces deflected through the range of angles anticipated for the glider elevons and rudders. Basic data are required to establish methods for computing the incremental heating rates for the glider.

Test Articles/Outline: From 9 to 12 plates will be mounted in the tunnel flush with the wall. These models will be heavily instrumented with pressure and temperature sensing instruments. Where possible Schlieren or shadowgraph pictures and oil flow pictures will be taken.

Test Facilities:

BHWT

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 7-118

This Test Supports - Data required to establish design heating rates for glider

Date Data Req'd: 8 '62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬▬▬

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-12 Responsible Company: Boeing

Test Title: TURBULENT REFERENCE AND LEADING EDGE ROUGHNESS HEATING RATE TESTS (SPO APPROVED TEST #14)

Test Objective/Justification:

1. Obtain fully turbulent leading edge, nose and flat plate data at wall, stagnation, and boundary layer edge flow property ratios characteristic of flight conditions.

2. Establish effect of transverse pressure gradient on roughness effects in laminar and turbulent flow. These data are required to establish design heating rates for the air vehicle.

Test Articles/Outline:

1. Leading edge model, smooth for 2/3 of the span, and an aft facing step approximately 1.4" deep on the leading edge would be located at this point. A simulated joint would be located near the cylinder - surface tangent lines along the full span.

2. A hemisphere-cylinder model with a slot simulating the nose cap - body joint.

3. A flat plate with interchangeable leading edges.

   Maximum number of instruments allowed by tunnel facility will be required on each model.

Test Facilities: Cornell Aeronautical Lab

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
														▨									

EWA(s) No. 7-122

This Test Supports - Data required to establish design heating rates for glider

Date Data Req'd: April 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME AERO-DYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-13 Responsible Company: Boeing

Test Title: INTERFERENCE AND DEFLECTED CONTROL EFFECTS ON GLIDER HEATING RATES (SPO APPROVED TEST #160)

Test Objective/Justification:

1. To establish the heat transfer and pressure distributions for the canopy heat shield region in hypersonic flow with turbulent boundary layer.

2. To establish the effects of interference on heat transfer and pressure distributions in the aft half of the body-wing-elevon-fin regions in hypersonic flow with turbulent boundary layer. These data are required to establish design heating rates for the glider.

Test Articles/Outline:

1. A 1/10 scale model of the forward fuselage with good heat shield body gap detail.

2. A 1/25 scale model of the glider with movable elevons and rudders, removable vertical fins (with rudders).

Test Facilities: Cornell Aeronautical Lab

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
																		▨					

EWA(s) No._____

This Test Supports - Data required to establish design heating rates for glider

Date Data Req'd: 1962 Aug

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-15 Responsible Company: Boeing

Test Title: GLIDER FIN HEAT TRANSFER TESTS AT RHODES AND BLOXSOM HOTSHOT (SPO APPROVED TEST #1 1)

Test Objective/Justification:

To establish fin-rudder heating rate distributions with various rudder deflection angles at Mach 15 and 23.

Test Articles/Outline:

1 .040 scale glider model with 12 interchangeable sets of fins and elevons.

The new fin and elevon sets will be built to fit the existing AD666M-1 model.

Four runs of this test were made during the week of Dec. 17, 1962. The test has been discontinued until data from tests at other facilities have been evaluated.

Test Facilities:

Rhodes and Bloxsom Hotshot

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - Data required to establish design heating rates for glider

Date Data Req'd: June 1963

Flow Time (EWA Rel. to Compl.) _____ Test Period _____

1.1.1.1 GLIDER AIRFRAME AERO-DYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-16 Responsible Company: Boeing

Test Title: X-20A GLIDER FIN AND ELEVON HEAT TRANSFER TEST AT CORNELL AERO. LAB. 48" SHOCK TUNNEL (SPO APPROVED TEST #192)

Test Objective/Justification:

To provide design data for revised elevon, fin and rudder at Mach 6 and 15.

Test Articles/Outline:

New fins and elevons will be built for the AD648M-1 (.04 scale) glider model. Geometry will be established from data obtained in SPO#191, 197 and 198.

Approximately 120 runs are proposed at M≈6 and 15 with various attitudes and rudder and elevon positions.

Test Facilities:

Cornell Aeronautical Laboratory 48" Shock Tunnel

Schedule:

1963												1964											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - Data required to establish design heating rate for glider

Date Data Req'd: August 1963

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REV 5-16-3
FORM 2-6181-1-1

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. [illegible]
		Responsible Company: Boeing

Test Title: AEDC HOTSHOT II DATA VERIFICATION TEST WITH AD463M-3 MODEL (SPO APPROVED TEST NO. 194)

Test Objective/Justification:

To obtain high Mach number data on X-20A forward fuselage in AEDC Hotshot II at Mach 19 and 22.

The data will be correlated with existing Mach 6 - 16 data from various facilities.

Test Articles/Outline:

One .200 scale model of the nose of the X-20A (existing model AD463M-1) modified for this test. Modifications consist of changes to instrumentation. Twelve runs are planned at various altitudes and Mach numbers 19 and 22.

Test Facilities:

Arnold Engineering Development Center, Hotshot II

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - Data required to establish design heating rates for glider

Data Data Req'd: April 1963

Flow Time (EWA Rel. to Compl.) ▭▭▭ Test Period ▨▨▨

REV 5-16-3
FORM 2-6181-1-1

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-19 Responsible Company: Boeing

Test Title: GLIDER NOSE CAP LEADING EDGE AND LOWER SURFACE JOINT HEAT TRANSFER TESTS AT CORNELL AERO LAB. (SPO APPROVED TEST #200)

Test Objective/Justification:

To obtain heating rate data on the effects of alternative nose joint geometries at Mach 15.

Test Articles/Outline:

A one-third (.333) scale model of the forward fuselage will be built. Three interchangeable nose caps will enable nose cap joint investigation. Instrumentation will be located in and adjacent to the joints insofar as possible.

Approximately 32 runs are planned at various attitudes.

Test Facilities:

Cornell Aeronautical Laboratory

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - Data required to establish design heating rates for glider.

Date Data Req'd: June 1963

Flow Time (EWA Rel. to Compl.) ▭ **Test Period** ▨

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-30 Responsible Company: Boeing

Test Title: HEATING RATE DISTRIBUTION STUDIES ON X20A GLIDER IN PROXIMITY TO JOINTS (SPO #201)

Test Objective/Justification:

To obtain detailed design heating rate distributions on X-20A in proximity to nose, leading edge and lower surface joints, at Mach 19 and 22.

Test Articles/Outline:

1) A full scale model of the X-20A from STA 117.86 to STA 147 including nose, leading edge and lower surface joints.

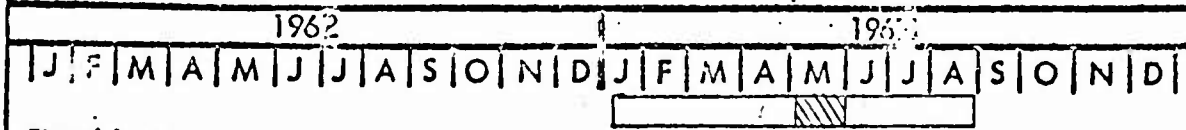
2) A smaller scale model incorporating the reaction jets in the upper wing leading edge in addition to the joints mentioned above.

Twenty runs at various attitudes and Mach number are planned.

Test Facilities:

Arnold Engineering Development - Tunnel F

Schedule:



EWA(s) No._____

This Test Supports - Data required to establish design heating rates for glider

Date Data Req'd: August 1963

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.1 GLIDER AIRFRAME AERODYNAMIC DEVELOPMENT STRUCTURAL HEATING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3-1 Responsible Company: Boeing

Test Title: Effects of Panel Stiffening Configuration in Heat Transfer Rates (SPO #195 & 196)

Test Objective/Justification: Objective is to determine the effects of alternative panel stiffening methods on heat transfer coefficients. Additional data is required to complete panel design.

Test Articles/Outline:

AEDC model consists of a flat plate 28 inches long by 20 inches wide by 2 inches thick with a sharp wedge leading edge. Model has provisions for separate instruments inserts. Six different insert configurations will be tested in the plate. Separate inserts of same configuration will be required for pressure tests and temperature tests. Testing will be accomplished at M = 10 at angles of attack 0° to 15° yaw angle 0°.

Cornell model consists of a wedge leading edge flat plate 22 inches long by 18 inches side by 1 inch thick with 5 configurations of roughness inserts. Testing will be conducted at M = 15 at angles of attack 0° to 15° yaw angle 0°.

Test Facilities:

AEDC Tunnel "C"

Cornell Aero Lab 48"

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

AEDC-C CORNELL

EWA(s) No. 5-509 & 5-510

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭▭▭▭ Test Period ▨▨▨▨

1.1.1.1 GLIDER AIRFRAME AERO DYNAMIC DEVELOPMENT STRUCTURAL HEATING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3-2 Responsible Company:

Test Title: Fin Leading Edge and Elevon Gap Heating Rates (SPO #197 & #198)

Test Objective/Justification:

Objective is to obtain effect of fin leading edge and elevon gap geometry on local heat transfer rates. This data is required to complete design.

Test Articles/Outline:

BHST model is that used in SPO #112 modified for this test. Testing will be accomplished at M = 22 at angles of attack of 15°, 20°, 30° and 40°, angles of yaw of 0 + 5° ± 10° and elevon deflections of 0 + 5° ± 10°. Heat transfer data will be taken.

AEDC model is that used in SPO #39 modified for this test. Testing will be accomplished at M = 10 at angles of attack of 15°, 20°, 30° and 40°, angle of yaw 0° and elevon deflections of 0°, 5° ± 10° and -20°.

Test Facilities:

Boeing Hot Shot (44")

Arnold Center Tunnel "C"

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

BHST ▨ ▨ AEDC-C

EWA(s) No. 5-511 & 5-512

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REV 5-16-3
FORM 2-6181-1-1

Program Element No.	Brief No.
1.1.1.1	26

Test Title: Booster Flow Field Surveys (Second Stage Vehicle)

This plan relocated in Program Element No. 1.6.1.8, Brief 2-1, page 200.1.

Design Development test plans in the following areas are included in D2-6783-1, "Structural Integrity Development & Test Program - Detail Plan - Structures Technology".

1.1.1.2 Airframe - Structural Integrity

Materials and Processes Development

Basic Allowables

Structural Environment

Component Allowables

1.1.1.3 GLIDER AIRFRAME-MISCELLANEOUS STRUCTURAL DEVELOPMENT-Seals, Latches, & Misc Attach	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: PNEUMATIC SEAL-PILOT'S HATCH DEVELOPMENT TESTS

Test Objective/Justification: The test objective is to verify predicted leakage rates and substantiate the use of pneumatic seals for pilot's hatch and similar access openings in pressurized compartments.

Limited data on this seal application and relatively large deflections in surrounding structures preclude analytical predictions of leakage rates.

Test Articles/Outline: The test article will consist of a simulated pilot's hatch (26x40) and surrounding structure mounted on a pressure test fixture.

Currently available seals will be tested to compare their performance and leakage rates under simulated operating conditions on full scale hatch structure. Tests will be conducted in a thermal and pressure environment simulating flight conditions to provide data for total mission leakage predictions.

Supplemental testing will be conducted to determine permeability, burst pressure, and the significance of sublimation of elastomers subjected to high altitude environments.

Test Facilities: Existing Boeing laboratory facilities will be utilized for this test. Either a 5'x6'x5' rectangular or a 6' diameter by 8' deep environmental chamber will be required.

Schedule: 1 **Incompatibilities between "Date Data Required" and Test Completion Date will be resolved by changes to released drawings as required by test results.**

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-155

This Test Supports - Drawing Release-Pilot's Compartment Access Door & Equip. Compartment Access Door Seals

Date Data Req'd: 7-1-62 1

Flow Time (EWA Rel. to Compl.) ▭ **Test Period** ▨

47

FORM 2-6181-1-1
Revised 3-29-2

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1.1.1.3 GLIDER AIRFRAME - MISCELLANEOUS STRUCTURAL DEVELOPMENT - Seals, Latches, & Misc. Attachments	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: **PRESSURE WINDOW SEAL DEVELOPMENT TESTS**

Test Objective/Justification: **The test objective is to determine leakage rates for window seals in the pilot's compartment.**

Investigation indicates that existing window mounting and sealing techniques are satisfactory for the Dyna-Soar program. However, the leakage allowables require that tests to be conducted to accurately determine leakage rates.

[redacted]

Deleted - This test covered under Struct. Tech. Doc. D2-6783-1

[redacted]

Test Articles/Outline: **An aluminum box test fixture that can simulate compartment deflections will be used to simulate installation of the largest window.**

Tests will be conducted in a pressure and thermal environment simulating flight conditions. Test fixture will be pressurized to 8.0 psig to simulate maximum attainable compartment pressure.

Test Facilities: **Existing Boeing laboratory facilities will be utilized for this test. Test article size has not yet been determined. However, existing environmental chambers are satisfactory.**

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 5-725

This Test Supports - Drawing Release - Pilot's Compartment Window Seals

Date Data Req'd: 6-30-62

Flow Time (EWA Rel. to Compl.) [redacted] Test Period [redacted]

FORM 2-6181-1-1
Revised: 3-29-62

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1.1.1.3 GLIDER AIRFRAME - Miscellaneous Structural Development. Seals, Latches & Misc.Attach.	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5.1 Responsible Company: Boeing

Test Title: Edge Attachment & Seal Development - Pilot's Compartment Pressure Windows

Test Objective/Justification: The objective of this test is to develop a pressure window seal that will be compatible with Dyna-Soar leakage requirements. Leakage requirements demand careful investigation in this area.

Test Articles/Outline: A full size window including edge attachment representative of the Dyna-Soar window design will be fabricated and mounted in a simple pressure vessel.

The test article will be subjected to load and environmental conditions to verify the mounting technique and to evaluate the performance of the seal.

Test Facilities: Existing Boeing Laboratories Facilities

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-440

This Test Supports - Verification, Pressure Window Design

Date Data Req'd: 11-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

50a

FORM 2-6181-1-1
REV 3-29-2

1.1.1.3 GLIDER AIRFRAME - MISCELLANEOUS STRUCTURAL DEVELOPMENT - Landing Gear	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: Boeing/NASA

Test Title: **LANDING GEAR HIGH SPEED DROP TESTS**

Test Objective/Justification: Determine internal gear loads, evaluate the integrated gear system dynamic characteristics under simulated operating conditions, and verify skid component's compatibility with the design landing requirements. The test is a necessary part of the landing gear development program to confirm the gear concept suitability and to evaluate the effects of operating parameters on the integrated gear system.

Test Articles/Outline: A full scale mass simulated glider structure will be mounted on the Langley landing loads track sled so that it may be dropped at sink rates from 4 feet per second to 10 feet per second and at various pitch, yaw and roll angles. Tests will be conducted at a sled speed of 130 knots.

CANCELLED 12-27-61
IN LIEU OF LESS COSTLY HOLLOMAN AFB SLED TEST

Test Facilities: The test will be conducted by the NASA Langley Research Center, Landing and Impact Branch, Langley AFB, Virginia. The test hardware will be installed on the 60,000 pound test carriage of the Langley Landing Loads Track.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-114

This Test Supports - Landing Gear Design Release

Date Data Req'd: 6-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.3 GLIDER AIRFRAME - MISCELLANEOUS STRUCTURAL DEVELOPMENT - Landing Gear	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: Boeing/Holloman

Test Title: LANDING GEAR HIGH SPEED TESTS

Test Objective/Justification:

Determine internal gear loads due to skid friction and runway irregularities and evaluate nose landing gear and main landing gear skid wear and structural characteristics under simulated operating conditions. The test is a necessary part of the landing gear development program to confirm the skid concept suitability and to evaluate the effects of operating parameters on the landing gear assemblies.

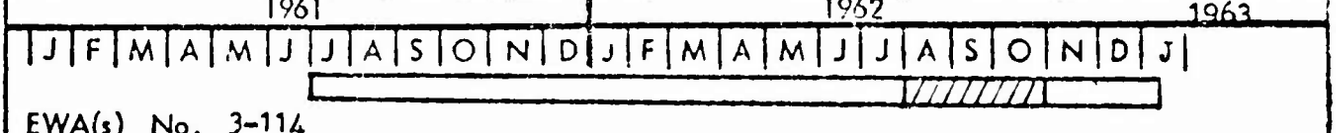
Test Articles/Outline:

The nose gear and main gear skid assemblies will be mounted on the Holloman test sled so that simulated slide-out and impact loads may be applied to the skids. Tests will be conducted at 225 knots diminishing to zero in a slide-out distance of 5000 feet. Tests will include runway irregularities to evaluate the skid capability of operating over bumps. Skid friction and wear on concrete, lake bed and asphalt will be determined.

Test Facilities:

The test will be conducted by Boeing at the Holloman Aif Force Base Track Facility. The test hardware will be installed on the rocket-propelled high-speed sled.

Schedule:



EWA(s) No. 3-114

This Test Supports - Landing Gear Design Release

Date Data Req'd: 1-15-63

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.3 GLIDER AIRFRAME - MISCELLANEOUS STRUCTURAL DEVELOPMENT - Landing Gear	DESIGN DEVELOPMENT TEST PLAN	Brief No. 8 Responsible Company: Boeing/Edwards

Test Title:

HARD COATED X-15 LANDING GEAR SKID TEST

Test Objective/Justification:

Evaluate the friction and wear properties of the Bendix hard coat on dry lake bed, concrete, and asphalt runways. The test is a necessary part of the landing gear skid development to correlate laboratory test information with actual skid tests at an early date.

Test Articles/Outline:

One left-hand and one right-hand X-15 main landing gear skid, coated with Bendix hard coat cermet number 3131-33. Tests will be conducted at maximum test velocity attainable from the test vehicle. Tests will include runs on dry lake bed, concrete, and asphalt to determine coefficient of friction. Final tests will be run on concrete until cermet surface is worn through to determine wear characteristics.

Test Facilities:

The tests will be conducted by AFFTC at Edwards Air Force Base. The test hardware will be installed on the existing X-15 landing gear drop test vehicle.

Schedule:

EWA(s) No. 3-411

This Test Supports - Landing Gear Design Release

Date Data Req'd: 5-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.3 GLIDER AIRFRAME--MISCELLANEOUS STRUCTURAL DEVELOPMENT, LATCHES & MISC. ATTACH.	DESIGN DEVELOPMENT TEST PLAN	Brief No. 10 Responsible Company: BOEING

Test Title: HIGH TEMPERATURE SPRING TEST

Test Objective/Justification:

The object of this test is to determine the load relaxation of a René 41 helical compression spring at high temperature.

Relaxation data for René 41 springs at the temperatures encountered is presently not available.

Test Articles/Outline:

Test specimens, of the expected configuration for the umbilical door latch mechanism, will be tested at design loads and temperatures, and load relaxation will be determined.

Test Facilities:

Boeing development laboratories.

Schedule:

ISSUE 1963												ISSUE 1964											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
			▨																				

EWA(s) No. 3-653

This Test Supports - FINAL DRAWING RELEASE, UMBILICAL DOOR LATCH MECHANISM

Date Data Req'd: 5-1-63

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.1.3 GLIDER AIRFRAME-MISCELLANEOUS STRUCTURAL DEVELOPMENT-Landing Gear	DESIGN DEVELOPMENT TEST PLAN	Brief No. S1 Responsible Company: Bendix Corp.

Test Title: NOSE GEAR SKID DEVELOPMENT TESTS

Test Objective/Justification: The objective is to evaluate the design of the nose gear skid under simulated operating conditions and verify its compatibility with design landing requirements. The test is a necessary part of the landing gear development program to confirm feasibility of the landing gear design concept.

Test Articles/Outline: The vendor, Bendix Corporation, will test three nose skid assemblies and a suitable number of representative material specimens. These articles will be used in the Static, Impact, Shear, Wear, Temperature, Pressure and other tests specified in Source Control Drawing 10-20921, "Skid Assembly, Nose Landing Gear (Test Only)."

Test Facilities: Facilities and instrumentation will be furnished by the vendor.

The operation test will be conducted at Holloman AFB by Boeing.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - Prototype Delivery to Boeing for Holloman Sled Tests

Date Data Req'd: 6-13-62

Flow Time (EWA Rel. to Compl.) ☐ **Test Period** ▨

1.1.1.3 GLIDER AIRFRAME-MISCELLANEOUS STRUCTURAL DEVELOPMENT- Landing Gear	DESIGN DEVELOPMENT TEST PLAN	Brief No. S2 Responsible Company: Goodyear Co.

Test Title: MAIN GEAR SKID DEVELOPMENT TEST

Test Objective/Justification: The objective is to evaluate the design of the main landing skid under simulated operating conditions and verify its compatibility with design landing requirements. This test is a necessary part of the landing gear development program to confirm feasibility of the landing gear design concept.

Test Articles/Outline: The vendor, Goodyear Tire and Rubber Company, Aviation Products Division, will test three main skid assemblies and a suitable number of representative material specimens. These articles will be used in the Static, Impact, Shear, Wear, Temperature, Pressure and other tests specified in Source Control Drawing 10-20914, "Skid Assembly Main Landing Gear (Test Only)".

Test Facilities: Facilities and instrumentation will be furnished by the vendor.

The operation test will be conducted at Holloman AFB by Boeing.

Schedule:

EWA(s) No._____

This Test Supports - Prototype Delivery to Boeing for Holloman Sled Tests

Date Data Req'd: 6-13-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.1.3 GLIDER AIRFRAME-MISCELLANEOUS STRUCTURAL DEVELOPMENT- Landing Gear	DESIGN DEVELOPMENT TEST PLAN	Brief No. NASA1 Responsible Company: NASA

Test Title: LANDING GEAR MODEL DROP TESTS

Test Objective/Justification: The purpose is to obtain additional information on dynamic characteristics during Dyna-Soar Landing touchdown and slideout with a 1/10 scale model. NASA has determined that this test will be a valuable adjunct to the Full Scale Model High Speed Drop Tests.

Test Articles/Outline: NASA has designed and constructed a 1/10 scale model of the Dyna-Soar and is making landings on a plywood runway.

Test Facilities: NASA is conducting these tests as their own research program using their own facilities at the Langley Research Center, Langley, Virginia. Detailed schedules will not be presented since Boeing is not directly involved.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭▭▭ Test Period ▨▨▨

35a

FORM 2-6181-1-1

FEB 3-25-2

1.1.2.1 PROPULSION-GLIDER ACCELERATION ROCKET	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Thiokol (Elkton)

Test Title: Acceleration Rocket Motor Design Development Test

Test Objective/Justification: The objectives of these tests are to evaluate the components, assemblies, and full-scale Acceleration Rocket Motor when subjected to simulated environment and load conditions; to determine the Acceleration Rocket Motor compatibility with the glider propulsion requirements; and to establish a fixed design configuration. These tests are a necessary part of the Development Program to confirm the Rocket Motor operating parameters.

Test Articles/Outline: The Acceleration Rocket Motor vendor will subject components, sub-assemblies, and assemblies to physical and functional tests prior to full-scale motor testing. The ballistic elements (propellant, insulation, liner, inert slivers, adhesives, and ignition elements) will be subjected to physical, functional, and aging tests. Rocket motor case and aft closure assemblies will be proof and hydroburst pressure tested. The ignition assembly (safe and arm, squibs, initiator and pyrogen) will be tested as components and then assemblies. The thrust vector controlling nozzles will be evaluated on 10 ¼-mass flow motor firings (single nozzle motors) prior to full-scale motor tests. One full-scale "used" motor case will be cast with live propellant, instrumented with thermocouples, and subjected to temperature gradient conditioning tests. The full-scale motor test plan defined on page 48.1.

Test Facilities: The tests will be conducted at the facilities of the Thiokol Chemical Corporation, Elkton Division, Elkton, Maryland, except that the one rocket scheduled for altitude firing will be tested at Arnold Engineering Development Center, Tullahoma, Tennessee.

Schedule:

EWA(s) No. P/O#2-043404-9554

This Test Supports - Design and Manufacture of Glider Propulsion System

Date Data Req'd: 2-18-63

Flow Time (EWA Rel. to Compl.) ⊏═══⊐ Test Period ▨▨▨▨▨▨▨▨

Test Article/Outline (continued)

FULL-SCALE FIRINGS ACCELERATION ROCKET MOTOR (XM-92)

No. of Motors (35)	Pre-Test Environmental Condition [2]	Test Firing Environment: Motor Temp. High	Motor Temp. Normal	Motor Temp. Low	Simulated Altitude Ignition	Grain Temp. Gradient Condition	Test Objectives
4 [1]	None		X		(1)		Determine Ballistic Performance
2	X	X					Determine Ballistic Performance
1	X		X				Determine Ballistic Performance
3	X	X			(2)		Evaluate Thrust Vector Performance
3	X		X		(1)		Evaluate Thrust Vector Performance
3	X			X	(2)		Evaluate Thrust Vector Performance
3	None	X			(1)		Evaluate Thrust Vector Performance
2	None		X				Evaluate Thrust Vector Performance
3	None			X	(1)		Evaluate Thrust Vector Performance
3	None	X			(2)		Determine Ballistic Performance
2	None		X				Determine Ballistic Performance
3	None			X	(2)		Determine Ballistic Performance
1	X					X	Evaluate effects of temperature gradient on performance and on propellant and insulation bonds.
1	None					X	
1 [3]	None	Ambient					Evaluate altitude performance, base heating insulation effectiveness, altitude ignition characteristics, and exhaust gas recirculation characteristics.

[1] These motors are of the "heavy weight" case configuration

[2] These motors subjected to individual or combinations of sequential conditioning to temperature cycling, rough road, vibration, drop, altitude cycling, humidity, and altitude conditioning prior to firing. Components only to be subjected to salt spray and sand & dust.

[3] This firing to be conducted in altitude chamber (Arnold Engineering Development Center, Tullahoma, Tennessee.)

1.1.2.1 PROPULSION-GLIDER ACCELERATION ROCKET	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Thiokol (Elkton)

Test Title: Accoleration Rocket Motor Explosive Hazard Test

Test Objective/Justification: The objectives of these tests are:

1. To obtain ICC hazardous handling classification to permit transportation by commercial carrier.

2. To obtain the military hazardous handling classification and to determine the hazardous characteristics of the rocket in order to confirm the preliminary hazardous classification assigned for planning the handling, storage, and transportation of the rocket motor.

These tests are a necessary part of the Development Program to satisfy ICC and Military Hazard Testing requirements.

Test Articles/Outline: The Explosive Hazard Test Plan is divided into Phases I, II, and III as follows:

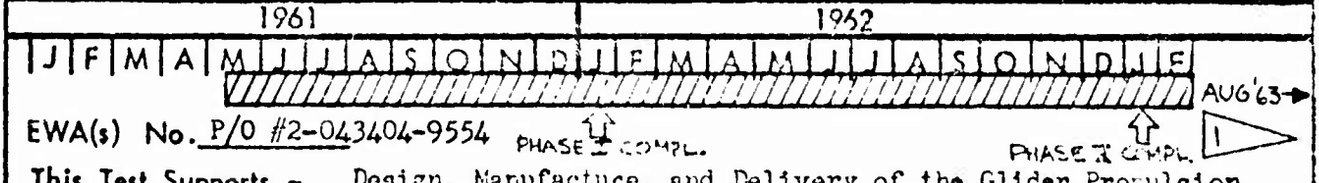
Phase I The following propellant sample tests are performed on 10-gram and 1 3/4-inch cube propellant samples: a. Trauzl Lead Block Test; b. Autoignition Test; c. Unconfined Burning; d. Thermal Stability Test; and e. Bureau of Explosives Impact Test.

Phase II The following Critical Diameter Detonation Tests will be conducted on sub-scale propellant grains: a. Critical Diameter detonation on 8-inch grains; b. High velocity impact on 5-inch development motor, 50 caliber; c. External heat 5-inch development motor.

Phase III The following tests are conducted on 5 full-scale motors: a. 40-ft. drop; b. Fire Test; c. High Velocity Bullet Impact; and d. Propagation of detonation at -10°F and +120°F.

Test Facilities: The Phase I tests will be conducted at the Bureau of Explosives Laboratories, American Association of Railroad Companies, South Amboy, N.J. The Phase II and III tests will be conducted at Edwards Air Force Base, California, by government employees attached to that site.

Schedule: PHASE III COMPLETE, AUG. 31, 1963.



1.1.2.1 PROPULSION-GLIDER ACCELERATION ROCKET	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: BOEING

Test Title: Acceleration Rocket Motor Environmental Shroud Tests

Test Objective/Justification: The objectives of the Environmental Shroud Tests are to 1.) verify the structural integrity of the environmental shroud to withstand the loads subjected during B52 air carry, 2.) verify the burst characteristics of the shroud during rocket motor ignition and 3.) to study the durability of the base section of the shroud throughout the burn time of the rocket motor under sea level conditions. Verification will be obtained by testing the shroud to 100% of operating loads and 100% of design ultimate loads. If abnormal results are encountered, revisions to the shroud will be incorporated.

Test Articles/Outline: One shroud will be tested on a developmental Acceleration Rocket Motor firing to subject the shroud to the rocket motor sea level ignition pressure buildup and base heating environment. Another shroud will be static pressure tested to simulate external pressure loadings, then pressurized internally to determine its separation characteristics. Pressure instrumentation [illegible] and visual inspection of the test article will establish the adequacy of the environmental shroud.

Test Facilities: One shroud will be transported to Thiokol Chemical Corp., Elkton Division, [illegible] Maryland for a test on the Acceleration Rocket Motor. The static t[illegible]ucted in the Boeing Laboratories. No special equipment is req[illegible]

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-595

This Test Supports - Design of the Shroud

Date Data Req'd: 3-15-63

Flow Time (EWA Rel. to Compl.) ____ Test Period ////////

App. 2-13-65

FORM 2-6181-1-1

1.1.2.2 PROPULSION-ORDNANCE DEVICES
Hatch Ejection

Responsible Company:
Unknown

Test Title: EXPLOSIVE BOLTS FOR PILOT'S ESCAPE HATCH

Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

1.1.2.2 Propulsion - Ordnance Device Chart Port Cover Release	DESIGN DEVELOPMENT TEST PLAN	Brief No. Responsible Company: Unknown

Test Title: EXPLOSIVE FASTENERS FOR BLAST PORT COVER RELEASE

Test Objective/Justification: Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

Test Articles/Outline:

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭ Test Period ▨▨▨▨▨

1.1.2.2 PROPULSION - ORDNANCE DEVICES. Glider/Transition Separation & Abort Separation	DESIGN DEVELOPMENT TEST PLAN	Brief No. Responsible Company:

Test Title: EXPLOSIVE FASTENER FOR GLIDER/TRANSITION SEPARATION AND ABORT SEPARATION

Test Objective/Justification:

Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

Test Articles/Outline:

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.2.2 PROPULSION-ORDNANCE DEVICES
Glider/Transition Separation

Responsible Company
Unknown

Test Title: PROPELLANT ACTUATED THRUSTERS FOR GLIDER/TRANSITION SEPARATION

Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

1.1.2.2 PROPULSION - ORDNANCE DEVICES
Unmanned Glider Destruct System

Responsible Company:
Unknown

Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

1.1.3.1 SECONDARY POWER POWER GENERATION	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: HYDROGEN DISPOSAL TEST

Test Objective/Justification: To determine what degree of susceptibility to fire or explosion and injury to personnel will be created by hydrogen that evolves from leakage, venting and exhausting from the APU and Environmental Control Subsystem.

To insure that hydrogen in the glider will not present a hazard to personnel or equipment.

DELETED as duplication of "Hydrogen Disposal Systems Test" Servicing and Environmental Equipment, Test Brief No. 2, Page 202.1.

Test Articles/Outline: Articles of test hardware needed are hot gas source, gaseous hydrogen and oxygen, simulated portion of B-52 wing that the AP&GU will exhaust through, AP&GU exhaust duct (actual or simulated) and simulated glider secondary power bay.

1. Hot-gas (1200°F) will be generated by the hot-gas source and will flow through the simulated exhaust duct and simulated B-52 wing at flow rates up to 90#/hr.

2. Hydrogen will be admitted to the Secondary Power Bay at a rate as may be experienced by hydrogen leakage from the Environmental Control Subsystem and by hydrogen flowing back into the Secondary Power Bay after passing through the exhaust duct.

Test Facilities:

Test will be conducted at the Boeing Tulalip Facility.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-304

This Test Supports - SIL Tests B-52 Captive Flight

Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.3.1 SECONDARY POWER - Power Generation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: **AP & GU/Hydraulic & Electrical Power Distribution Development Test**

Test Objective/Justification: **The APU development is primarily a subcontracted effort. However, due to the development status of the hydraulic, electrical and cryogenic environmental control systems which are so integrally mated with the APU, a certain amount of design development testing is required by Boeing to insure that the overall integrated system design proceeds on a timely basis. Data will also be gathered to support the design of the APU exhaust duct.**

The objective of this testing is to investigate the performance and capabilities of the APU when operated in conjunction with prototype hydraulic and electrical power distribution systems prior to Design Integration testing in the Environmental Simulator. (The cryogenic subsystem mating development is covered by Test Brief #6, Section 1.1.4.4.)

Test Articles/Outline: **A prototype AP & GU will be mated with prototype hydraulic and electrical distribution systems. Hydraulic and Electrical loads will be applied concurrently and environment will be varied in accordance with conditions specified in the source control drawing.**

Deleted - this work is accomplished by Test Brief No. 6, page 82 (Breadboard Cryogenic Tests).

Test Facilities: **Boeing Tulalip Hazardous Test Facility**

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-300

This Test Supports - The integration testing required to assure that the APU design is compatible with the rest of the Secondary Power.

Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1
APU 3-27-2

1.1.3.1 SECONDARY POWER POWER GENERATION	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Sundstrand

Test Title: APU DESIGN DEVELOPMENT TEST

Test Objective/Justification: To develop an APU to provide electrical and hydraulic power for the Dyna-Soar.

Test Articles/Outline: Test Articles are: complete APU's, gearboxes, combustors, control systems, regenerators, cold plates, pumps, and generators.

Tests to be completed:

1. Control Performance
2. Vibration
3. Endurance
4. Heat Rejection
5. Radio Interference
6. Turbine Performance
7. Environmental
8. Acceleration and Attitude Freedom

Test Facilities:

Vendors Facilities

Schedule:

1961												1962												1963		
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1
REV 3-27-2

1.1.3.2 SECONDARY POWER Electrical Power	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: High Temperature Wire and Connector Evaluation

Test Objective/Justification: To evaluate high temperature wire and connectors for use in unconditioned areas of the glider. This evaluation is necessitated because insufficient data is available on the wire and connectors for the extreme temperatures of the Dyna-Soar application.

The tests will (1) determine suitability of "off-the-shelf" high temperature wire (EWA 3-290); (2) verify wire installation temperatures (EWA 3-290); and (3) test and evaluate to determine the overall compatibility and thermoelectric accuracy of the complete instrumentation electrical circuit consisting of (a) high temperature connectors, (b) high temperature wire, (c) wire splices, and (d) compensating lead wire. (EWA 3-291)

Test Articles/Outline:

1. Wire of single and multiple conductors with various types of insulation.
2. Connectors of single and multiple pin configurations with various types of insulation.
3. Wire splice and compensating lead wires.

Wire and connectors will be tested to determine the ability of the insulation and configuration to withstand high temperature, low pressure, corona, and vibration. In addition, connectors will be tested for pressure and moisture sealing capabilities.

Test Facilities: Annex D Laboratories and Boeing Labs. 2.01 Bldg.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-290 & 3-291

This Test Supports - Design of Wire Bundle Assemblies in Uncontrolled Environment Areas

Date Data Req'd: Aug. 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.1.3.2 SECONDARY POWER Electrical Power	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: POWER QUALITY SIMULATOR TESTS (TERMINATED, 1/31/62) [1]

Test Objective/Justification: To obtain knowledge and experience of the power supply characteristics for development of qualification test procedures. These procedures together with the capability of their execution will be a requirement for the qualification of all electrical load equipment. To prove reliable performance of such equipment during dynamic changes of power quality in the Dyna-Soar glider. Such procedures and testing would establish a precedence heretofore unavailable.

Test Articles/Outline: A static inverter/frequency changer (Tel-Instrument unit No. 4300-3-E12 - modified) will be operated to prove its capability of performance within the desired requirements. Typical loads will be employed to develop the desired test procedure.

[1] Equipment specifications are being revised to eliminate the requirement for proof of reliable performance during dynamic changes of power quality.

Test Facilities: Boeing Electrical Laboratory, 2.01 Bldg.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-177

This Test Supports - Development of Qualification Test Procedures

Date Data Req'd: 3-1-62

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭ Test Period ▮▮▮▮▮▮▮▮▮▮

1.1.3.2 SECONDARY POWER Electrical Power	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: **Electrical System Components**

Test Objective/Justification:

To evaluate state-of-the-art electrical components to determine suitability and/or development requirements for use in Boeing designed electrical system assemblies. These tests will determine source, electrical performance, and configuration of parts to be used in assemblies.

DELETED as design development test. State-of-the art components more properly categorized as standards which may or may not require further testing to satisfy D-6 requirements.

Test Articles/Outline:

1. **Fuses, fuseholders**
2. **Electrical relays**
3. **Switches**
4. **Diodes**
5. **Electric connectors**
6. **Cockpit lighting transformer**
7. **Electric wires**

Test specimens will be operated under environmental conditions which simulate glider flight conditions.

Test Facilities:

Test facility, Boeing Electrical Laboratories, 2.01 Bldg.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-288 3-290

This Test Supports - Electrical system assemblies design, parts selection

Date Data Req'd: April, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

REV 3-29-62
FORM 2-6181-1-1

1.1.3.2 SECONDARY POWER Electrical Power	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: Boeing

Test Title: ELECTRICAL SYSTEM ASSEMBLIES, DESIGN DEVELOPMENT

Test Objective/Justification: To test the Boeing designed electrical panels and assemblies of the glider electrical system to assure that the designs developed are in accordance with environmental and electrical performance requirements.

Test Articles/Outline:

1. Main Power Box
2. Subsystem Electrical Relay Panels
3. Forward Load Box Panels
4. Blocking Diode Assembly

These assemblies will be tested for vibration, corona, acceleration, shock, altitude temperature rise, and electrical performance.

Test Facilities:

Boeing Elec. Laboratory 2.01 Bldg.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-292

This Test Supports - Design of Electrical System Assemblies

Date Data Req'd: July 9, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

REV 3-29-62
FORM 2-6181-1-1

1.1.3.2 SECONDARY POWER ELECTRICAL POWER	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Westinghouse Electric

Test Title: AC GENERATOR AND CONTROLS UNIT

Test Objective/Justification: The first development test will be run to determine the operational characteristics of unknown or new components and to verify design calculations. As the development program progresses and hardware begins to materialize, development tests will take on a second function of verifying the design of units and their compatibility with the other units in the system.

Test Articles/Outline:

A. System Development
B. Generator Development
C. Voltage Regulator Development
D. Control Unit Development
E. Circuit Breaker Development
F. Differential Projection Current Transformer Development

Test Facilities:

Westinghouse Electrical Corporation, Lima, Ohio, "G" Building

Schedule:

Schedules are being revised - new dates will be available 4-15-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. All tests by Westinghouse per Proposal 2093, July 1961

This Test Supports - Design of AC Generator and Controls Unit

Date Data Req'd: 8-15-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.3.2 SECONDARY POWER
Electrical Power

Responsible Company:
Unknown

Test Title: TRANSFORMER-RECTIFIER UNIT

Subcontractor design development testing will be determined during contract negotiations with the selected vendor. Contract with a vendor is expected to be signed by 4-1-62.

1.1.3.2 SECONDARY POWER ELECTRICAL POWER	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7
		Responsible Company: Boeing

Test Title: Back-up Transformer for T-R Unit

Test Objective/Justification: The objective is to verify the design of a transformer designed by Boeing as a back-up for the transformer included in the Transformer-Rectifier (T-R) Unit developed by the Electro Development Corporation (EDC) under SCD 10-20908. (See Test Brief No. 6, page 61). A back-up transformer design is being developed to assure at minimum cost that EDC will produce on schedule a T-R unit that will meet the performance and weight requirements of SCD 10-20908.

COMPLETED
12-1-62

Test Articles/Outline: Boeing Designed Back-up Transformer. The transformer will be tested to verify that when installed in the T-R unit, the T-R unit will meet the requirements of SCD 10-20908.

Test Facilities: Boeing, 2.01 Building, Magnetics Laboratory

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-578

This Test Supports - Design of T-R Unit, SCD 10-20908

Date Data Req'd: Nov. 15, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨ 9-20-62

1.1.3.3 SECONDARY POWER Hydraulics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: HYDRAULIC TUBING AND FITTING EVALUATION

Test Objective/Justification: To select the lightest and most reliable permanent and reconnectable hydraulic tubing and fittings capable of meeting the requirements of the Dyna-Soar Hydraulic System.

Because of the higher operating temperature of the Dyna-Soar Hydraulic System, and the adverse effect of leakage on the insulation around the tubing, a leak-free tubing and fitting configuration is necessary.

Test Articles/Outline: (1) Metallic tubing of various degrees of hardness and wall thickness, and (2) Various tube end fittings of different materials, permanent and reconnectable.

Tests will be run in three steps: (1) screening tests at room temperature, (2) endurance tests at elevated temperatures,
(3) tests to determine installation torques, and (4) random vibration tests. During the above tests, the following will be accomplished: (1) leakage measurements, (2) proof and burst pressure tests, (3) reconnectability tests, and (4) the ease of installation, susceptibility to surface imperfections, and adequacy of dual seals will be determined.

Test Facilities: Mechanical Propulsion Laboratory - High temperature test cell with rotating beam fatigue tester, and vibration laboratory - random vibration tests.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-038

This Test Supports - Tubing and fitting Selection & Fitting Installation Requirements.

Date Data Req'd: 7-31-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

3-29-62

FORM 2-6181-1-1
Revised:

1.1.3.3 SECONDARY POWER Hydraulics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2
		Responsible Company: Boeing

Test Title: **HIGH TEMPERATURE HYDRAULIC SEAL EVALUATION**

Test Objective/Justification: The object is to secure reliable static and dynamic high-temperature seals for actuators and other components of the hydraulic system. One specific goal is to obtain dynamic seals capable of limited operation at 550°F. to provide added system operating time in event of a cooling system malfunction.

Hydraulic seal temperatures are normally limited to 400°F., however, radiant heat from the Dyna-Soar glider structures are expected to elevate hydraulic temperatures beyond this point.

Test Articles/Outline: Electromeric and metallic seals for static and dynamic applications will be tested. Testing will employ fluctuating pressures and temperature cycling under static and dynamic operating conditions.

Test Facilities: A seal screening test fixture, a pressure impulse tester, a seal friction tester, and several semi-hazardous test cells in the Mechanical Propulsion Laboratory in Annex "D".

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-044

This Test Supports - Selection of Hydraulic Seals and Actuator Dynamic Response Studies.

Date Data Req'd: ~~6-30-62~~ 8-30-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

AV 3-29-2

1.1.3.3. SECONDARY POWER - HYDRAULICS	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: EVALUATION OF METHODS FOR COOLING HYDRAULIC ACTUATORS

Test Objective/Justification: The objective is to determine a hydraulic actuator cooling and insulation configuration which will provide an acceptable limitation of actuator fluid and seal temperatures under ambient conditions consistent with the Dyna-Soar re-entry path.

The hydraulic actuators will be subjected to radiant heat from structure at temperatures of 1100°F. to 1650°F. Actuator seal and fluid temperature limitations are approximately 400°F.

~~TESTING COMPLETE 7-27-62~~ → { Additional testing required due to increased rudder temperatures & re-design of the actuator rod length (2-1-63). R

Test Articles/Outline: The test specimen shall be a fluid jacketed hydraulic actuator insulated to reduce heating by thermal radiation from hot structure.

The actuator will be installed in a test setup which provides simulated altitude and thermal environmental conditions. Actuator fluid flow simulation will be controlled with adjustable orifices from the hydraulic pressure supply system.

Test Facilities: Altitude tests will be conducted in the high altitude equipment test chamber, Mechanical Propulsion Laboratory, Annex "D".

Schedule:

1963

J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
													▨	▨	▨	▨							

R

EWA(s) No. 3-047

This Test Supports - Selection of Actuator Designs and System Cooling Requirements

Date Data Req'd: 6-1-63

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REV 2-13-3
FORM 2-6181-1-1

: HYDRAULIC FLUID EVALUATION

: The objective is to provide accurate data on the viscosity, bulk modulus, flash point, fire point, S.I.T., and lubricity of various hydraulic fluids for the Dyna-Soar hydraulic system, and to select the optimum fluid for that system.

Accurate data on high pressure viscosity, bulk modulus, and shear stability is currently unavailable for most of the high temperature fluids under consideration. It is essential that these values be determined for the fluid in a useable form (after shearing) to design a safe, stable flight control system.

COMPLETED
2-1-62

: The following fluids will be evaluated initially: (1) MIL-[illegible], a naphthenic base mineral fluid, (2) MIL-[illegible], a disiloxane synthetic fluid, and (3) MIL-[illegible], a paraffinic base mineral fluid.

The test fluid will be pumped into the hydraulic system at 3000 psi and 275°F. at a flow rate of 7.0 gpm. It will pass through a heat exchanger system which will raise the fluid temperature to 400°F. A throttling orifice will then cool the fluid to 275°F.

Before and after the shearing test, the viscosity, bulk, modulus, flash point, fire point, S.I.T., and lubricity will be measured.

: A high temperature pumping system, a bulk modulus test fixture, and several semi-hazardous test cells in the Mechanical-Propulsion Laboratory, Annex "D".

:

J F M A M J J A S O N D

Test(s) No. 3-153

Test Does Supports - Selection of Hydraulic Fluid

Test Date Req'd: 10-15-61

Flow Time (Est. Wks. to Compl.) Test Period

1.1.3.3 SECONDARY POWER - Hydraulics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: DEVELOPMENT OF INSULATED HYDRAULIC TUBING AND SERVO WIRING ASSEMBLIES

Test Objective/Justification: The primary objective is to determine heat transfer characteristics of insulated hydraulic lines, servo wiring, and tube clamps at Dyna-Soar fluid and structural temperatures and altitudes. The insulation and fluid flow required to keep temperatures below the maximum allowed for teflon-covered wire will be determined.

Test Articles/Outline: Selected hydraulic tubing and wire bundle configurations will be placed in an environmental chamber and supported by various clamp configurations. Hydraulic fluid at the temperature and flow rate expected during re-entry will be circulated through the tubes and the temperature and altitude will be varied in the chamber also to simulate re-entry conditions. An optimum insulation/fluid flow wire temperature control configuration will be determined. Random vibration tests of the insulated and clamped tubing assemblies will be performed at various conditions of temperature, pressure, flow, prestress, and altitude.

Test Facilities: Boeing Mechanical Propulsion Laboratory high altitude equipment test chamber (same as for section 1.1.3.3, Brief No. 3).

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-217

This Test Supports - Tubing Insulation Selection and System Cooling Requirements.

Date Data Req'd: 7-31-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.3.3 SECONDARY POWER Hydraulics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6
		Responsible Company: Boeing

Test Title: EVALUATION OF FLEXIBLE LINES AND/OR SWIVEL JOINTS

Test Objective/Justification: Due to flexure and unequal expansion and/or contraction of structural components of the glider, many of the tubing runs may require expansion joints. Hydraulic system components such as pumps, reservoirs, actuators, etc. which have relative motion with respect to each other or to the structure will require flexible connections. Service experience with teflon hose and other flexible connections is poor under conditions less severe than those of Dyna-Soar. Tests will be performed to provide design data for a lightweight and reliable hydraulic system.

Test Articles/Outline: Individual tests will be conducted on flexible hose, coiled tubing, and miscellaneous flexural components to suit the specific requirements developed by design studies of the hydraulic tubing system. To be included in these tests will be some endurance cycling during simultaneous flexure and pressure pulsing. In general, fluid temperatures and ambient temperatures will simulate the conditions to be encountered for specific applications.

Test Facilities: Tests will be conducted in the Boeing Mechanical Propulsion Laboratory, and in the Vibration Laboratory.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-218

This Test Supports - Selection of Flexible Lines and Connectors

Date Data Req'd: 3-15-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

3-29-62
FORM 2-6181-1-1

1.1.3.3 SECONDARY POWER HYDRAULICS	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: Boeing

Test Title: EVALUATION OF SEALING CONCEPTS FOR HYDRAULIC RESERVOIR

Test Objective/Justification: To determine the sealing concept most capable of meeting the Dyna-Soar reservoir environmental and operational conditions.

This is necessary since a new sealing concept for both fluid and precharge gas is required in order to obtain a highly reliable minimum weight design.

Test Articles/Outline: The test specimen will be thin walled reservoir piston and several types of elastomeric seals.

It will be mounted in a simulated reservoir and cycled under the conditions of operation to be encountered during Dyna-Soar reservoir ground check-out, boost, orbit, and re-entry.

Test Facilities: A semi-hazardous test cell and high temperature hydraulic fluid source in the Mechanical Propulsion Laboratory.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-358

This Test Supports - Selection of Reservoir Seals and Dynamic Response Studies

Date Data Req'd: 5/31/62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

SLV 3-29-62

FORM 2-6181-1-1

1.1.3.3. Secondary Power Hydraulics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 8 Responsible Company:

Test Title: BREADBOARD TESTING OF THRUST VECTORING CONTROL SYSTEM - ACCELERATION ROCKET

Test Objective/Justification: To determine design requirements of the Servo System, the tests are required to set parameters of mechanical and electrical portions of the servo to assure compatibility.

Test Articles/Outline: The test articles will be prototype electro-hydraulic valve and actuator assy plus breadboard electronics. Performance tests run with various mechanical prototype configurations will be accomplished.

Test Facilities: Vendor Laboratory

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Vendor Test

This Test Supports - Acceleration Rocket and FCSE

Date Data Req'd: Vendor's Choice

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭ Test Period ▨▨▨▨▨

1.1.3.4 SECONDARY POWER
Reaction Control Power

Responsible Company:
Boeing

Design development test planning in this area has been included under GLIDER FLIGHT CONTROL - MANUAL CONTROL - Reaction Control Power Component (Section 1.3.1.2)

1.1.3.5 SECONDARY POWER Pneumatics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: TUBING AND FITTING EVALUATION - HIGH PRESSURE PNEUMATIC SYSTEMS

Test Objective/Justification: Tests must be conducted to develop configurations with suitable temperature cycling, strength, vibration endurance and connect and reconnect characteristics. Off-the-shelf tubing and fittings are not suitable for the temperatures (up to 1700°F.) and pressures encountered in this application.

This test is cancelled per Design Groups (Coord Sheet Mech 1239, dated 3-23-62)

Test Articles/Outline: The choice of materials to be used in the tubing and fitting program will be based on information obtained from other high temperature materials developments conducted at Boeing. Vendors will be requested to furnish fittings of the chosen material. These fittings will be assembled into test samples.

Tests will be conducted as follows: (1) Proof and burst tests, (2) Temperature and pressure cycling tests, (3) Vibration Tests, (4) Connect and reconnect tests, and (5) Breadboard tests (Simulate the main landing gear extension system) using a gas generator as the power source.

Note: Test (1) will be conducted with hydraulic fluid. Tests (2) through (4) will be conducted with nitrogen gas.

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-271

This Test Supports - EAMR Releases for Landing Gear Extension and Window Heat Shield

Jettison Tubing Distribution Systems

Date Data Req'd: 4-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

REV 3-29-62
FORM 2-6181-1-1
Revised

1.1.3.5 SECONDARY POWER PNEUMATICS	DESIGN DEVELOPMENT TEST PLAN	Brief No. S1 Responsible Company:

Test Title: Clamps for Pneumatic Tubing

Test Objective/Justification: Tests will be conducted to evaluate tubing clamps under conditions of structural loading, ambient temperature, and vibration which will be encountered in the pneumatic systems of the Dyna-Soar glider. These tests are necessary for the development of clamps to meet the Dyna-Soar requirements.

Test Articles/Outline: Samples of clamps will be subjected to the following temperature and load-vibration requirements:

1. Ambient temperature -65°F to 1800°F.
2. Vibration-Load
   a. Vibrate at critical frequencies with a force of 5 pounds applied normal to the tube for 1/2 hour.
   b. Vibrate at critical frequencies with a force of 10 pounds applied parallel to the tube for 1/2 hour.

Test Facilities:

The tests will be conducted by the vendor @ vendor facilities.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. [illegible]

This Test Supports - The Pneumatic Systems

Date Data Req'd: 7-1-62

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭▭ Test Period ▨▨▨▨▨▨

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: The Boeing Company

Test Title: GEL HANDLING DEVELOPMENT AS APPLIED TO THE WATER WALL

Test Objective/Justification: Determine:

1. Optimum means to make the GEL and how to use the GEL selected for the water wall.
2. The pressure and temperature bracket of the GEL needed for transporting (pumping) from the source to the water wall panel.

Different GELS are being investigated for water wall use. From these GELS, one will be selected for its physical characteristics. The handling techniques peculiar to the water wall must be determined.

COMPLETED
3-1-62

Test Articles/Outline:

1. Gelling Agent
2. Miscellaneous test specimens

Outline:

1. Pump GEL through a fill circuit with no water wall specimen. Note pressure and temperature drops and any other peculiarities.
2. Repeat above until the technique of handling is such that the successful filling of a water wall panel is possible.
3. Determine final pressure and temperature bracket in conjunction with test brief 2.

Test Facilities:

Water wall development area, shop 2-3924, Annex D, Plant II.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-404

This Test Supports - Tests 2, 3, 10, 11 & 12

Date Data Req'd: Mar. 1, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1
REV 3-25-2

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: The Boeing Company

Test Title: **FILL TESTS OF WATER WALL PANELS**

Test Objective/Justification: **To determine one filling technique that can be used for all water wall panels satisfactorily.**

COMPLETED 2-26-62

Test Articles/Outline: **There will be four specimens initially, representing the largest panel to be used on the glider. The panels will be filled at prescribed angles with the horizontal to reduce uneven filling due to hydrostatic head and still allow drainage of excess coolant. The panels will be weighed to determine total coolant held. The balance point of each panel will be determined to detect uneven coolant distribution within the panel.**

Test Facilities:

Mechanical-Propulsion Laboratory and Shop 2-3924. This testing requires the preparation and handling of gel. All testing will be at room temperature.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-40

This Test Supports - Tests 3, 10, 11, 12, 13

Date Data Req'd: Feb. 1, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: The Boeing Company

Test Title: STORAGE EVALUATION

Test Objective/Justification: Determine: The percent of coolant lost from the water wall over a given time period in a controlled atmosphere.

Background literature does not provide sufficient information to accurately predict the percentage of coolant lost during storage of the mylar water wall.

COMPLETE
10-15-62

R

Test Articles/Outline:

There will be 12 samples representative of different water wall areas.

	No. Samples	Time	Temperature	Humidity	
1.	2	3 months	70°F	20%	
2.	2	3 months	70°F	50%	
~~3.~~	~~2~~	~~3 months~~	~~70°F~~	~~80%~~	Complete
4.	2	3 months	130°F	20%	
~~5.~~	~~2~~	~~3 months~~	~~130°F~~	~~50%~~	Complete
6	2	3 months	130°F	80%	

After the storage tests, the panels will be topped off and the variation between top off weight and initial full weight noted. Perform a leak check and note results.

Test Facilities:

Mechanical-Propulsion Laboratory.

Test requires an environment chamber.

Schedule:

EWA(s) No. 3-404

This Test Supports - Predicted Storage Life

Data Data Req'd: ~~1-1-63~~ 1-1-63

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REV. 2-13-3
FORM 2-GIGI-1-1

1.1.4.1 Environmental Control, Passive Cooling	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 A Responsible Company: The Boeing Company

Test Title: WICK PANEL LIFE TEST

Test Objective/Justification: It is the objective of this development to develop a wick panel which will resist deterioration at elevated temperatures (1.e above 80° F) which are anticipated during the period between installation and launch. It is also the object of this development to develop the time-temperature limitations of the wick panel.

Test Articles/Outline: Materials used in the fabrication of the wick panels will be subjected to various temperature-time periods to establish materials capabilities. The best materials will be selected and wick panels built and tested to establish the temp-life capabilities.

Test Facilities:

Schedule:

EWA(s) No. 3 - 4 0 4

This Test Supports - PREDICTED STORAGE LIFE

Date Data Req'd: 1 1 / 1 / 6 3

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

ADD 2-13-3

FORM 2-6181-1-1

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: The Boeing Company

Test Title: **WATER WALL GROMMET DEVELOPMENT**

Test Objective/Justification: **Determine:**

1. **Shape of the grommet**
2. **Method of installation**

The grommets pass through the water wall and convey the water wall load to the LHT fasteners. No leaks are permitted in the water wall around the grommets.

COMPLETED 2-26-62

Test Articles/Outline:

1. **Six grommets for each necessary configuration.**
2. **Larger quantities of the configuration considered to be most satisfactory.**

Outline:

1. **Design and fabricate six grommets of one configuration.**
2. **Install in water wall panel and evaluate for leaks, sturdiness, ease of installation, etc.**
3. **Design, fabricate and install a second configuration incorporating the changes dictated by the prior configuration.**
4. **Repeat until satisfactory grommet configuration and installation techniques are achieved.**

Test Facilities:

Shop 2-3924 and Water Wall Development Area in Annex D, Plant II.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-40B

This Test Supports - Preliminary Grommet Design and Tests 10, 11, 13

Date Data Req'd: Mar. 1, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: The Boeing Company

Test Title: LHT FASTENERS FOR WATER WALL

Test Objective/Justification: Determine:

1. Optimum method for installing fasteners.
2. Torque requirements.
3. Determine effect of heat transfer thru fastener in simulated flight.

The LHT fastener is a new design and there is no test data from which to predict the capabilities or limitations of this fastener.

COMPLETED 7-1-62

R

Test Articles/Outline:

Test Articles: LHT fasteners used in the fabrication of the water wall.

Outline:

1. Methods for handling, installing, and removing will be determined for water wall installation.
2. Torque requirements will be determined for water wall installation.
3. Test fasteners in Test Brief No. 11 (page 72.11) for thermal data required.

Test Facilities:

Mechanical-Propulsion Laboratory and Shop 2-3924.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-403

This Test Supports - Prelim. Fastener Design & Tests-10, 11, 13

Date Data Req'd: Sept 1, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

REV. 2-13-3
FORM 2-6181-1-1

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: The Boeing Company

Test Title: WATER WALL PANEL SLIDE GUIDE DEVELOPMENT

Test Objective/Justification: Develop methods and techniques to make the water wall panel easy to install and remove from the compartment without removing compartment from vehicle.

No satisfactory method or technique has been developed for readily removing and installing water wall panels. This is part of the basic water wall design criteria.

COMPLETED 2-26-62

Test Articles/Outline:

Fabricate panels and panel slide guides designed for given areas.

Outline:

Evaluate each panel and slide guide by handling characteristics and visual inspection.

Redesign and fabricate as required.

Test Facilities:

Shop B-398 and Water Wall Development Area in Annex D, Plant II.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-[illegible]

This Test Supports - Prelim. Slide Guide Design & Tests 7, 10, 11, 13

Date Data Req'd: [illegible], 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨ pp 73.5

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: The Boeing Company

Test Title: WATER WALL PANEL INSTALLATION-JOINT DEVELOPMENT

Test Objective/Justification:

1. Develop methods and techniques for covering joints between panels such as ground corners on the compartments.
2. Develop methods for installing insulation such that the water wall panels are easily removable.

No satisfactory method or technique has been developed for making joints in the insulation such that the water wall panels can be easily removed and installed. No open spaces are permitted in the panel joints when the panels are in place on the compartment.

Test Articles/Outline: COMPLETED 12-21-62 R

Test Articles:

Insulation, insulation cover, LHT fasteners, water wall panel, and simulated flat surface of compartment exterior in areas of joints.

Outline:

The first attempt will be to develop a joint common to several panels. Second, develop a specialized joint for specific areas not susceptible to a common joint.

Test Facilities:

Shop 2-3924 and Water Wall Development Area in Annex D, Plant II.

Schedule: 1 Preliminary Drawing Release Date

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 2-1607

This Test Supports - Prelim. Joint Design & Tests 10, 11, 13

Date Data Req'd: Jan. 31, 1963 1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REV 2-13-3
FORM 2-6181-1-1

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 8 Responsible Company: Boeing

Test Title: WATER WALL PANEL VAPOR VENT VALVE DEVELOPMENT

Test Objective/Justification:

1. Develop a vapor vent valve for the water wall panels.
2. Determine the valve's ability to handle the volume of steam expected during re-entry.
3. Develop installation methods and techniques.

No vapor vent valves have been developed and tested.

Test Articles/Outline:

Test Articles:

Several (two initially) vapor vent valves designed and fabricated for a specific panel.

Outline:

1. Test seal characteristics at sea level and maximum altitude.
2. Test performance while installed in a water wall panel during simulated thermal-altitude tests.
3. Redesign as necessary.

Test Facilities:

Mechanical-Propulsion Laboratory, Shop 2-3924, and Water Wall Development Area in Annex D, Plant II.

Schedule: 1 Preliminary Drawing Release Date

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-404

This Test Supports - Preliminary Valve Design and Tests 10, 11, 12

Date Data Req'd: Mar. 1, 1962 1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 9 Responsible Company: The Boeing Company

Test Title: OUT GASSING OF WATER WALL INSULATION

Test Objective/Justification: Determine:

1. Vent area necessary in the insulation cover to permit out gasing of insulation during boost without damage to the water wall and tie-downs.
2. Pressure gradient through the insulation from the compartment shell to the insulation cover.

The preliminary calculations contain several assumptions which need to be verified by test. Inadequate ventilation area causes a pressure differential between insulation and ambient pressures which would damage the water wall during boost.

Test Articles/Outline:

Three or more test parts and a test fixture representing different configurations.

Outline:

1. Place test specimen in altitude chamber and follow the vehicle boost rate to 200,000 feet.
2. Descent to sea level on the glide curve.
3. Observe and record effects and modify system as required.

Test Facilities:

Mechanical Propulsion Laboratory, Plant II testing requires an altitude chamber capable of following the venicle boost rate to 200,000 feet.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-404

This Test Supports - Supports Predicted Requirements for Out Gassing Insulation

Date Data Req'd: Feb. 15, 1962

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭▭ Test Period ▨▨▨▨▨▨

FORM 2-6181-1-1
12-29-61

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 10 Responsible Company: Boeing

Test Title: VERIFICATION WATER WALL VIBRATION TEST Mechanical and Sonic

Test Objective/Justification: Determine:

1. The effect of a random vibration spectrum imposed upon a typical water wall panel.
2. Functional adequacy, during vibration tests, of the design concepts established in tests 4, 5, 6, 7, and 8.

Calculations are not sufficiently reliable to make accurate definition of water wall natural frequencies or the effect of random vibrations on the tie-downs and vapor vent valves.

Test Articles/Outline: Test Articles:

1. 20" x 24" flat panel specimen
2. Four 28" x 28" flat panels
3. ~~One large size panel, approx. 4' x 7'~~
4. One specimen containing an insulation joint and hard point design
5. ~~One small specimen approx. 12" x 15" to be subjected to combined acceleration and vibration.~~

Above specimens incorporate design concepts established in tests 4,5,6,7,&8.

Outline:

1. Test 20" x 24" flat panel specimen first for preliminary information.
2. Test 28" x 28" flat panels, each to a different environment during testing.
3. ~~Test 12" x 15" specimen in combined accel. and vibration environment.~~
4. ~~Test 4' x 7' specimen.~~
5. Test insulation joint and hard point protection

Make changes to water wall components as necessary.

Test Facilities:

1. Static pressure source
2. Leakage rate measuring device
3. High and Low temperature environment
4. Altitude chamber

Schedule: Build Assy Drawing Release Date

1961												1962												1963
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J

EWA(s) No. 3-404

This Test Supports - Water Wall Design

Date Data Req'd: Sept 30 1963

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

REV 2-13-3
FORM 2-6781-1-1

BOEING NO D2-5697-16 VOL II
PAGE 72.9

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 11 Responsible Company: The Boeing Company

Test Title: THERMAL-ALTITUDE TESTS, WATER WALL COMBINATION VERIFICATION.

Test Objective/Justification: Determine:

1. The ability of the water wall to protect the compartment during a simulated mission profile.
2. Quantity of coolant remaining after testing.
3. The design parameters for various combinations of insulation thickness and coolant content on a square foot basis.
4. Functional adequacy, during thermal altitude tests, of design concepts established in tests 5, 7, and 8.

The heating rates vary from area to area on the vehicle. Verification of the flat panel design is needed to meet the updated schedule.

Test Articles/Outline:

1. All specimens will incorporate the design concepts established in tests 5, 7, and 8.
2. Several 10" x 10" specimens will be fabricated and tested. Each will be representative of the water wall in a specific area in both coolant per square foot and insulation thickness and density.
3. Several larger specimens will be fabricated and tested after the 10" x 10" specimens have performed satisfactorily.

Outline:

Each 10" x 10" specimen will be subjected to a simulated temperature-altitude profile to 200,000 feet.

Test Facilities:

Mechanical-Propulsion Laboratory

Test fixtures for these specimens are available.

Schedule:

1961												1962												1963
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J

EWA(s) No. 3-404

This Test Supports - Water Wall Design

Date Data Req'd: ~~August~~ 1962
OCT 1, 1963

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

2-15-63
FORM 2-6161-1-1

[illegible] PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Responsible Company: The Boeing Company

Test Title: THERMAL-ALTITUDE TESTS - COMPARTMENT HARD POINTS

Test Objective/Justification: Determine: The ability of the water wall to protect the compartment from heat conducted through the hard points.

Calculations are not sufficiently reliable to predict what quantity of heat will pass through the hard points and if the water wall will be damaged in these areas.

CANCELLED 2-13-3

R

Test Articles/Outline:

1. One test article of each structurally different hard point assembly and water wall will be fabricated.
2. Total of such articles will be approximately six.

Outline:

1. Fill water wall around and adjacent to hard point and subject the specimen to a simulated temperature-altitude profile for this area.
2. Repeat above test three times for each hard point assembly.

Test Facilities: Mechanical-Propulsion Laboratory. Test requires heating facilities and altitude chamber capable of simulating the expected temperature-altitude profile up to 200,000 feet and returning on the profile to sea level.

Schedule: [illegible]

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-404

This Test Supports - Water Wall Design

Date Data Req'd: Sept 30 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

REV. 2-13-3
FORM 2-6181-1-1

...4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 13 Responsible Company: Boeing

T **Title:** WATER WALL INSTALLATION TECHNIQUE

Test Objective/Justification:

1. Aid design in the evaluation of water wall panels in construction and installation problem areas.

COMPLETED
12-21-62

R

Test Articles/Outline:

1. Existing "mockups" will be utilized.
2. Mockup used for test brief 6.
3. Additional mockups of problem areas.

Outline:

Build and install selected panels which present difficult problems.

Test Facilities:

Shop 2-3924, and Water Wall Development Area in Annex D, Plant II, access to Class II and Class III mockups.

Schedule:

1961												1962											
F	M	A	M	J	J	A	S	O	N	D		J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-404

This Test Supports - Water Wall Design

Date Data Req'd: ~~Jan 1~~, 1962
Dec 30,

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

EW 2-13-3
RM 2-6161-1-1

1.1.4.1 ENVIRONMENTAL CONTROL, PASSIVE COOLING	DESIGN DEVELOPMENT TEST PLAN	Brief No. 14 Responsible Company: The Boeing Company

Test Title: Water Wall For Transducers

Test Objective/Justification:

The object is to develop and demonstrate by test a water wall system for transducers remotely located from the compartment water walls.

Transducers must be protected from the effects of aerodynamic heat. Proof that the water wall system provides adequate thermal protection for the transducers is needed.

Test Articles/Outline:

Test articles will consist of an instrumentated water wall system which surrounds the transducers.

The test article will be subjected to the temperature and pressure environment expected in the transducer area for a once around mission.

Initially one article will be tested and results analyzed. Further testing will be performed only if the results are inconclusive.

Test Facilities:

1. Altitude Chamber
2. Multi-Point Temperature Recorder

Schedule:

1961												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-600

This Test Supports - Transducer Water Wall Design

Date Data Req'd: 12-1-63

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

PP 73.13

REV 5-16-3

1.1.4.2 ENVIRONMENTAL CONTROL - Active Cooling	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: ENVIRONMENTAL CONTROL TUBING AND FITTINGS

Test Objective/Justification: Determine suitability of fittings, port seals, tubing and insulation for cryogenic use. These tests will also be used as qualification tests.

Insufficient data available on performance of tubing and fittings under conditions imposed by Dyna-Soar requirements.

Test Articles/Outline: This test will consist of reconnection, leakage, proof, bending, cycle, and burst tests conducted where applicable on permanent tube joints, reconnectable joints, and 10050 port seals and tube materials.

The test will essentially be a bending cycle test conducted at 350 psi for low pressure equipment and at 2250 psi for high pressure equipment. Temperature will be cycled from -420°F to 150°F during bending tests. Cycle tests will be periodically interrupted to perform reconnection, leakage, and proof tests. Upon completion of the bending cycle tests, the surviving fittings will be burst.

Similar tests will be conducted on insulated tubing and fittings. Heat leak tests will also be conducted.

Test Facilities: Boeing facilities - Hazardous Test Area Tulalip Test Site

Schedule:

EWA(s) No. 3-197

This Test Supports - Environmental Control Plumbing Design

Date Data Req'd: 7-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

REV 3-29-62
FORM 2-6181-1-1

2.1.4.3 ENVIRONMENTAL CONTROL Cryogenic Tankage	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: **EXPULSION DIAPHRAGM (COMPLETED)** (10-12-61)

Test Objective*/Justification: The purpose of the test is to develop a diaphragm capable of expelling cryogenic liquids. The attachment of the diaphragm to the tank is a part of this development effort.

A reliable diaphragm to expel liquid O_2 and N_2 from the glider storage tanks is not now available, therefore, one is being developed.

*Diaphragms are no longer a tankage system requirement. By agreement with the Assistant Project Engineer, the testing will continue up to September 30, 1961 to evaluate the development done to date.

Test Articles/Outline: Approximately 6 diaphragms of promising configuration will be fabricated and tested.

The diaphragm specimens will be cycle tested with liquid nitrogen and gaseous helium. Each diaphragm which fails will be analyzed to determine cause of failure to evaluate development done to date. The diaphragms to be fabricated will have only a flat flange for attachment in the test tank.

COMPLETED
10-12-61

Test Facilities: Boeing Mechanical Propulsion Laboratory, Annex "D"

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-196

This Test Supports - EAMR Release for Diaphragm

Date Data Req'd: Dec. 1961

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.4.3 ENVIRONMENTAL CONTROL
Cryogenic Tankage

Responsible Company:
Boeing

Test Title: TANK STRENGTH AND MATERIAL SCREENING

These test plans are contained in Section II of D2-6783-1, "Structures Integrity Development and Test - Detailed Plan - Structures Technology."

1.1.4.4 ENVIRONMENTAL CONTROL - Cryogenic Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: SUPERCRITICAL HYDROGEN STORAGE SYSTEM WITH BOILERPLATE TANK

Test Objective/Justification: To determine: (1) Methods of filling the tank and initially obtaining a supercritical pressure; (2) A method of maintaining the required tank pressure with the simulated flow requirements; (3) The thermodynamic parameters of ϕ & θ for hydrogen; (4) The extent of stratification under simulated flow conditions and means of reducing stratification.

This testing is necessary due to lack of data and hardware available to meet the Dyna-Soar requirements.

Test Articles/Outline: The hydrogen storage system consists of a boiler plate hydrogen tank, a hydrogen loop with a regulated return line, a glycol loop, a heat exchanger, flow control valves, and an electric heater.

Fill, vent, and pressurizing procedures will be established first. Tests will be made to determine the boil-off rate of the hydrogen with no addition of heat other than through the insulation, load rods and plumbing. System tests will begin with constant flow rates of 0.1 to 1.0 lb/min discharged overboard to simulate environmental control and accessory power flow rates. The required pressure within the tank will be held as constant as possible during these tests. Tests will be run to measure the heat required to maintain the pressure at various hydrogen densities, and flow rates.

Test Facilities: Boeing, Tulalip Test Site No. 1

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-176

This Test Supports - Breadboard Integrated Environmental Control & Secondary Power Subsystem Test (Brief No. 6)

Date Data Req'd: Feb. 1, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

3-29-62
FORM 2-6181-1-1

1.1.4.4 ENVIRONMENTAL CONTROL Cryogenic Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: SUPERCRITICAL HYDROGEN STORAGE SYSTEM WITH PROTOTYPE TANK [1]

Test Objective/Justification: Compare performance of prototype tank with that of the boiler-plate hydrogen tank. This is necessary to evaluate the compatibility of the prototype tank with the system concept and to determine the validity of the data obtained on the boilerplate tank test (Test Brief, No. 1, Section 1.1.4.4).

Test Articles/Outline: Tests conducted previously on the boiler-plate hydrogen tank (Test Brief No. 1, Section 1.1.4.4) will be repeated using the same setup except for substitution of the prototype tank to obtain a direct comparison of the two. The tank will first be filled, then tested for heat leak and pressurized to 300 psia. With the tank installed in the system, a typical flight profile will be run with hydrogen flows simulating APU, Reaction Control and overboard dump.

[1] EWA 3-381 provides only for fabrication of the prototype tank; testing will be accomplished under EWA 3-282.

Test Facilities: Boeing, Tulalip Test Site No. 1

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-381

This Test Supports - Breadboard Integrated Environmental Control & Secondary Power Subsystem Test (Brief No. 6) Date Data Req'd: 7-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

3-29-62
FORM 2-GIRI-1-1

1.1.4.4 ENVIRONMENTAL CONTROL Cryogenic Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: BOILERPLATE O_2 STORAGE SYSTEM TESTS

Test Objective/Justification: To determine the ability of the O_2 storage system to supply the O_2 to the various equipment using the O_2 during the mission. To be sure of the tank system performance, the tank must be subjected to the simulated flows and the environments it has to perform under.

Test Articles/Outline: The testing will consist of two phases called phase (a) and (b):

(a) To establish fill procedure, to determine heat leak, and to develop a method to detect the fluid in the tank at any time during the mission. To determine the tank ullage, ϕ Parameter and ~~θ~~ Parameter.

(b) Test the O_2 system for expulsion rates at design and off design limits.

Test Facilities: Tulalip Test Site Area 1

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-222

This Test Supports - Breadboard Cryogenic Development Tests (Brief No. 6)

Date Data Req'd: 1 Nov. 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.4.4 ENVIRONMENTAL CONTROL Cryogenic Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4
		Responsible Company: Boeing

Test Title: HYDROGEN AND OXYGEN STORAGE SYSTEMS

Test Objective/Justification: The objectives of this test are to: (1) Determine if there are any areas of incompatibility between the oxygen and hydrogen pressurization methods; (2) Determine the effect of a prototype reaction control system on the hydrogen and oxygen system; (3) Determine the effect of an APU combustor on thehydrogen and oxygen system; and (4) Determine transient conditions in the APU cryogenic supply.

DELETED - to be accomplished by Test Brief 6, page 82.

Test Articles/Outline: These tests will be conducted with the same equipment used in Test Brief No. 2, Section 1.1.4.4 except a prototype reaction control system, APU combustors and an oxygen tank will be added to the system. Hydrogen and oxygen flow to the APU combustor will be regulated by laboratory-type flow controls. The reaction control system consists of vendor-furnished hardware for all except fittings and hot gas lines. The plumbing will be fabricated to duplicate a glider installation. Flow to the APU burner will be regulated by laboratory-type flow controls. The system will be checked out using simulated mission profiles with respect to cryogenic flow.

Test Facilities: Boeing, Tulalip Test Site No. 1

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-280

This Test Supports - Breadboard Integrated Environmental Control & Secondary Power Subsystem Test (Brief No. 6) Date Data Req'd: Oct. 1, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.4.4 ENVIRONMENTAL CONTROL Cryogenic Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: PROTOTYPE ENVIRONMENTAL CONTROL EQUIPMENT WITH SIMULATED GLIDER COMPARTMENTS

Test Objective/Justification: Objectives of this test are to: (1) Evaluate vendor's prototype environmental control equipment; (2) Investigate glycol control problems; (3) Study effects of transients in the glycol loop on APU and reaction control; and (4) Evaluate a prototype glycol-hydrogen heat exchanger.

DELETED - to be accomplished by Test Brief 6, page 82.

Test Articles/Outline: This test utilizes the same equipment used in Test Brief No. 3 except that a prototype environmental control system will be substituted for the boilerplate system, simulated APU's, generators, hydraulic oil coolers and simulated glider compartments with heaters will be added. Preliminary tests will be set up in the laboratory to evaluate individual hardware items. Simulated mission profiles will be run. Failures will be simulated which affect the heat available for pressurizing the hydrogen tank.

The simulated APU's and generators only provide heat for the glycol system. The hydraulic oil heater simulates the entire oil cooling load (power and aerodynamic heat). The compartments will provide the approximate volume of the corresponding glider compartments. The compartment heater will simulate electrical, electronics, and aerodynamic heat loads.

Test Facilities: Boeing, Tulalip Test Site No. 1

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-281

This Test Supports - Breadboard Integrated Environmental Control & Secondary Power Subsystem Test (Brief No. 6)

Date Data Req'd: Dec. 1, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.1.4.4 ENVIRONMENTAL CONTROL
Cryogenic System

DESIGN DEVELOPMENT
TEST PLAN

BRIEF NO. 6
RESPONSIBLE COMPANY:
BOEING

TEST TITLE: Breadboard Cryogenic Development Tests

TEST OBJECTIVES/JUSTIFICATION: The objectives of these tests are to

(1) Demonstrate the compatibility of the AP & GU, primary glycol cooler, and hydrogen supply when operated together as a unit at:

   (a) Sea level pressure and transient or steady state load conditions

   (b) Reduced pressure and transient or steady state load conditions

   (c) Sea level pressure during pre-launch servicing.

(2) Provide integrated unit performance data for design improvements, analytical studies and flight test data evaluation.

(3) Develop and/or confirm operating and servicing procedures for integrated operation.

The testing will consist of two phases:

Hydrogen Servicing Tests: Initial tests will determine the heat leak of the hydrogen tank and a safe procedure for "securing" the hydrogen tank in case of emergency. Following these initial tests, the compatibility of the hydrogen AGE equipment with other prototype equipment during pre-launch servicing and the hydrogen servicing procedures for ground launch and air launch glider positions will be evaluated. All these tests will be conducted at sea level pressure.

Integrated Unit Tests: The integrated performance of the AP & GU, primary glycol cooler and hydrogen supply will be determined for various transient and steady state operation conditions.
These tests will be conducted at sea level and reduced pressure as well as rapidly increasing or decreasing pressures.

TEST ARTICLE/OUTLINE: The Breadboard Cryogenic Development Test Unit will consist of:

(1) Prototype hydrogen supply which includes;

   (a) Hydrogen tank
   (b) Fill, vent and safety controls.

(2) Single prototype AP & GU which includes;

   (a) Accessory power unit
   (b) Generator unit
   (c) Hydraulic pump
   (d) AP & GU controls and cold plate

1.1.4.4 ENVIRONMENTAL CONTROL Cryogenic System	DESIGN DEVELOPMENT TEST PLAN	BRIEF NO. 6 RESPONSIBLE COMPANY: BOEING

TEST ARTICLE/OUTLINE: (Continued)

(3) Prototype primary glycol cooler which includes;

(a) Glycol temperature controls
(b) Hydrogen tank pressure controls.

(4) Prototype hydraulic fluid cooler.

(5) Prototype cryogenic umbilical connections.

(6) Two prototype glycol pump units.

(7) AGE hydrogen servicing equipment which includes;

(a) Hydrogen pump
(b) Hydrogen precooler.

(8) Boiler Plate Oxygen Supply.

TEST FACILITIES: All these tests will be conducted at Boeing Tulalip Test Area No. 34 in the small altitude chamber.

SCHEDULE:

EWA(s) No. 3-282 & 3-381

THIS TEST SUPPORTS - Environmental Control & Secondary Power Integration Test (Reference D2-5697-16, Vol. VI) DATE DATA REQ'D: 4-1-63

FLOW TIME (EWA Rel. to Compl) ☐ TEST PERIOD ▨

1.1.4.4 ENVIRONMENTAL CONTROL Cryogenic Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: BOEING

Test Title: **APU EXHAUST SYSTEM DEVELOPMENT TEST**

Test Objective/Justification:

Objectives: Determine adequate means for exhausting hydrogen from the glider without danger to the air vehicle, support equipment, or personnel due to fire or explosion.

Justification: Ensure that hydrogen exhausted from the glider will not present a hazard to personnel or equipment.

Test Articles/Outline:

Articles of Test Hardware needed for the testing include:

1. Hot-Gas Source
2. Gaseous Hydrogen and Oxygen
3. Simulated Portion of Cork Insulated Transition Section around and including the Exhaust Depression
4. AP&GU Exhaust Duct (Actual or Simulated)
5. Hydrogen Vent Fitting (Actual or Simulated)
6. Hot Gas Cooler

Test Outline: (On following page)

Test Facilities:

The testing will be conducted at the Boeing Jet Lab Facilities.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-502

This Test Supports - BREADBOARD CRYOGENIC DEVELOPMENT TESTS (Test Brief No. 6)

Date Data Req'd: 7-31-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

3-29-62

TEST ARTICLES/OUTLINE: (Continued)

Test Outline: A series of test runs will be made with hot gas flowing through the APU exhaust duct into sea level ambient air. The oxygen and hydrogen gas mixture ratios will simulate glider usage conditions and the hot gas will be cooled to 350 to 750°F to simulate typical exhaust gas temperatures. The steam and hydrogen ratios in exhaust gases and the exhaust gas flow rates will simulate minimum to maximum APU&GU loading conditions for typical ground operation and checkout. Methods or systems for ensuring safe exhausting of hydrogen rich gases will be evaluated.

TEST BRIEF NO. 7

1.1.5.1 FIRE PROTECTION AND SAFETY SUBSYSTEM	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: **Toxicity and Flammability of Materials Study**

Test Objective/Justification: **To determine by review, testing and analysis the acceptability of materials exposed to the Pilot's Compartment as to flammability and toxicity characteristics.**

Test Articles/Outline: **All materials exposed to the Pilot's Compartment for which no conclusive information as to their toxicity and flammability characteristics are available. Testing will consist of TGA, D.T.A, gas chromatograph, mass spectrograph, chemical and exposure analyses as required.**

Test Facilities: **Materials and Processes Unit's Test facilities**

Industrial Hygiene and Safety Unit Test facilities

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-417

This Test Supports - The Dyna-Soar Glider Design Groups

Date Data Req'd: 6/15/62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

1.1.6.1 GLIDER PILOT STATION Pilot Station Arrangement	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: PILOT STATION ARRANGEMENT TESTS

Test Objective/Justification: To provide the necessary test experience required to achieve pilot interface arrangement in the glider pilot station compatible with pilot mobility, vision, ingress and egress, and control requirements.

The use of a unique full pressure suit and restraint system of unique mobility limitation, the use of minimal vision area because of high heating and the use of new ingress procedures due to the vertical glider position for pilot entry requires test experience to provide basic design data.

Test Articles/Outline: A wooden mockup pilot compartment providing the interior pilot compartment envelope, ejection hatch opening and window configuration will be equipped with mockups of the basic seat structure, parachute, survival kit container, head rest, ejection initiation control handle, arm rests, pilot operated controls, and full pressure suit (including helmet).

The above articles will be fabricated from engineering layouts based on engineering studies and installed in the mockup pilot compartment. Test subjects ranging in size from 5th to 75th percentile, dressed in a full pressure suit, will qualitatively evaluate the adequacy of the initial design. Adjustments will be made to initial hardware dimensions and locations until it is deemed that the pilot mobility, vision, ingress and egress, and control requirements, as they relate to hardware location, are satisfied. Prototype cockpit hardware is to replace wooden mockup equipment as it becomes available.

Test Facilities: Boeing Laboratories , DSM 4000 Mockup.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-171

This Test Supports - Cockpit Hardware Installation

Drawing Release Date Data Req'd: June 1, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

3-29-62

FORM 2-6181-1-1

1.1.6.1 GLIDER PILOT STATION Pilot Station Arrangement	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: BOEING

Test Title: DYNA-SOAR COCKPIT LIGHTING STUDY

Test Objective/Justification:

1. Investigate the effects of high level external illumination on the ability of the pilot to obtain required information from the instrument panel.
2. Select a tinted transparency to shield the windows if required.
3. Determine the type, number and location of light sources to give satisfactory illumination of the instrument panel.

Test Articles/Outline:

1. High altitude sunlight will be simulated by a suitable external light source, and the pilot's ability to use the instrument panel will be measured.
2. If test results show a requirement, suitable display shields and/or tinted window shades will be developed.
3. Various suitable light sources will be evaluated for satisfactory illumination levels on the instrument panel under conditions of orbital flight.

Test Facilities:

The existing DSM 4000 Mockup will be used as the test facility. The final configuration chosen will be installed in the operational mockup for verification.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-491

This Test Supports - Release of Engineering drawings and EAMR's for cockpit lighting installation.

Date Data Req'd: 6-19-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▮▮▮▮▮▮▮▮▮▮

1.1.7.1 GLIDER ABORT/PILOT ESCAPE -Ejection Seat and Survival Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. -
		Responsible Company: Weber Aircraft

Test Title: PILOT EJECTION SEAT TESTS

Test Objective/Justification: No vendor conducted development tests are contemplated since vendor design utilizes hardware of proven capability. Configuration development will be conducted as part of GLIDER PILOT STATION Engineering Development Mockup, 1.1.6.1, Brief No. 1

Test Articles/Outline:

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.1.9.1 TRANSITION SECTION Glider Separation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: INTRA-TRANSITION PRESSURE SURVEY TESTS
(SPO Approved Test #186)

Test Objective/Justification: These tests are to provide data concerning the magnitude and distribution of pressure in the transition compartment and over the booster blast shield due to acceleration rocket operation. Data will also be obtained for blast port design.

Detail information is required to support analysis of glider-booster separation characteristics, separation clearance studies, the booster associate contractor's design of the Stage II blast shield, and the design of the transition blast ports.

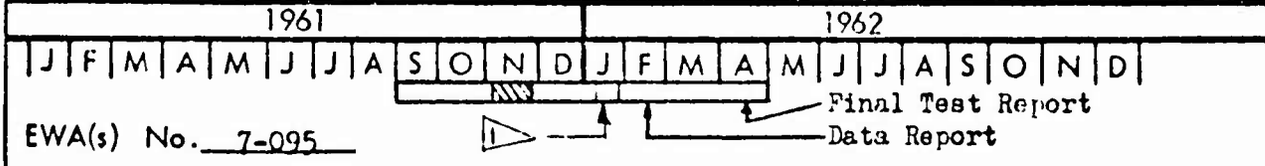
Test Articles/Outline: The test model will consist of a geometrically scaled transition section and forward part of the booster Stage II, including the blast shield. The forward portion of the transition section will incorporate a cold air supply flowing from a plenum through four nozzles simulating the acceleration rocket motor. An approximately 5 percent scale model will be used which requires a total air flow rate of approximately 1.5 pounds per second.

Tests will be conducted varying the following: Separation distance, nozzle deflection angle, alignment of forward and aft portions of model, blast shield shape, blast port area, and external free stream altitude and Mach number. During each test, recordings will be made of the plenum total air flow rate and pressure distribution in the transition compartment and on the blast shield.

Test Facilities: Lewis Research Center, Cleveland, Ohio

Schedule:

1 Testing scheduled for Jan. 1962 not carried out. No further testing will be accomplished on this program.



EWA(s) No. 7-095

This Test Supports - Transition design, determination of blast port area, glider-booster separation characteristics, and blast shield design.

Date Data Req'd: 2-15-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.9.1 TRANSITION SECTION Glider Separation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2
		Responsible Company: Boeing

Test Title: ROCKET EXHAUST FLOW FIELD TESTS; SUB-SCALE ROCKET EXHAUST TESTS (SPO Approved Test #143 - EWA #7-079)

Test Objective/Justification: These tests are to provide (1) data concerning heating rates and base pressure in the forward transition section resulting from acceleration rocket operation, and (2) effects of the rocket jet plume at nearly vacuum conditions.

The data will support selection of the type and amount of heat insulating material required and contribute to the selection of transition section structural materials.

Test Articles/Outline: Two series of tests will be conducted on a 7 percent model glider and forward transition section incorporating a solid propellant rocket motor. A third series of tests will be conducted on a 14 percent model of the same configuration. The first series will be conducted in the Supersonic Wind Tunnel. The second and third series will be conducted in a vacuum chamber. Each test will include the firing of a scaled rocket motor, while measurements are taken of the heating rates and pressures in the transition section.

Test Facilities: Boeing Supersonic Wind Tunnel; Boeing Jet Laboratory, Vacuum Chamber, Seattle

Schedule:

This Test Supports - Transition materials and insulation requirements for rocket motor and hydraulic package.

Date Data Req'd: 6-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

112. 3-29-62

1.1.9.1 TRANSITION SECTION Glider Separation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3
		Responsible Company: Boeing

Test Title: SCALE STAGING TESTS

Test Objective/Justification: These tests are intended to evaluate the thermal and pressure effects in the transition section and on the blast shield during glider abort separation, to provide information concerning the blast port cover release path, and to evaluate blast shield materials.

The data to be obtained from these tests are required to support design of the transition section (structure) and the blast shield, to evaluate heat insulation requirements and the separation sequence of events.

Test Articles/Outline: A 13.5 percent scale test model consisting of the transition section including a scaled rocket motor, the blast shield, and a mass simulating the presence of the glider, will be mounted horizontally in a test stand in a manner permitting complete separation. The separation rate will be controlled by the glider mass and by mechanical restraint devices simulating the calculated separation rate to be experienced under actual glider abort.

Recordings shall be made of the thermal and pressure effects in the transition section and on the blast shield. The recordings shall also show the timing of events during the separation sequence.

Test Facilities:

Boeing, Propulsion Test Facility, Tulalip, Washington

Schedule:

EWA(s) No. 3-163

This Test Supports - Transition section and blast shield design; evaluation of separation characteristics.

Date Data Req'd: 7-15-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.1.9.1 TRANSITION SECTION Glider Separation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4
		Responsible Company: Boeing

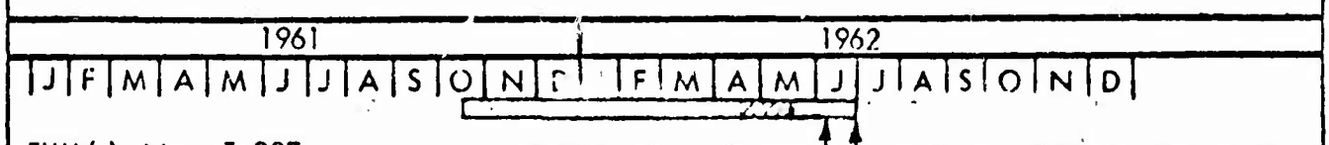
Test Title: BLAST PORT COVER DEVELOPMENT TESTS

Test Objective/Justification: These tests are to provide data to establish blast port cover detail design requirements and to evaluate the effects of temperature environmental conditions which the blast port covers are required to withstand. The data to be obtained from these tests are required to support design of the blast port covers and cover release devices.

Test Articles/Outline: The test article will consist of a portion of the full-size transition section which includes the blast port cover and cover installation device. Tests will include evaluation of pre-tensioning of the blast port cover bands as a means of (1) attaching the covers securely to the transition section and (2) compensating for thermal expansion in flight.

Test Facilities: Boeing, Structures Development Laboratory, Developmental Center, Seattle, Washington

Schedule:



EWA(s) No. 3-287

This Test Supports - Design of blast port covers and method of installation and latching

Date Data Req'd: 5-31-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.1.9.1 TRANSITION SECTION Glider Separation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5
		Responsible Company: Boeing

Test Title: FULL-SCALE STAGING TESTS

Test Objective/Justification: This test program is intended to provide the earliest possible evaluation of the glider abort separation characteristics with a full scale test article. The data to be obtained will serve to complete the detail flight design of the transition section, the blast shield, and equipment and circuitry to be mounted in the transition compartment. The data will enable evaluation of the separation sequence of events and definition of the intra-transition environment resulting from acceleration rocket operation. The post-test physical condition of the test article will furnish evidence of the effects of the intra-transition environment on the structure, equipment, and protective coverings selected.

Test Articles/Outline: The test vehicle will consist of a blast shield and transition section, incorporating blast port covers, rocket motor of short firing duration, and separation devices necessary for severance at the glider abort separation plane and release of the blast port covers.

~~Three~~ Two tests are planned and the vehicle is intended to be in a horizontal attitude with the aft transition and blast shield stationary, and the forward transition including the rocket motor, free to displace axially when the separation joint is severed. The separation rate will be adjusted to simulate the calculated rate under actual operating conditions. Time-related recordings shall be taken of the following: Transition section and blast shield pressure distribution and thermal conditions, acoustic environment, rocket motor performance, and separation sequence actuation signals.

Test Facilities:

Edwards Air Force Base Sled Track.

Schedule: 1 Incompatibility between "Date Data Required" and Test Completion Date will be resolved by changes to released drawings as required by test results.

EWA(s) No. 3-272

This Test Supports - Transition section and blast shield design; acceleration rocket motor hydraulic power package development; abort separation evaluation.

Date Data Req'd: 12-1-62 1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

REV 3-29-62
FORM 2-6181-1-1

1.2 Booster

Responsible Company:
Martin

Test Title: Booster Design Development Tests

The associate contractor, The Martin Company, is conducting design development tests in this area. Booster test plans are not within the scope of this document.

PAGES 91 THRU 137 HAVE BEEN DELETED.
These pages formerly covered Martin
test planning for Titan II.

1.3.1.1 GLIDER FLIGHT CONTROL - FLIGHT CONTROL SYSTEM ELECTRONICS - Minneapolis-Honeywell Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S1 Responsible Company: Minneapolis-Honeywell

Test Title: COMPONENT ADAPTABILITY TESTS

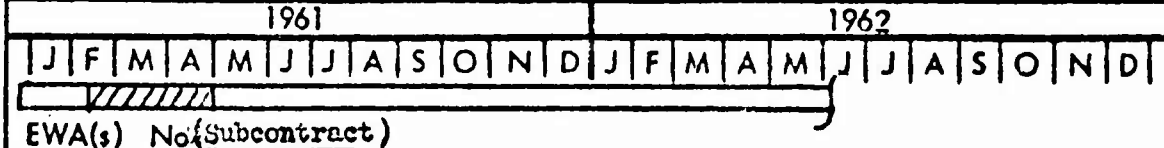
Test Objective/Justification: These series of tests are required to determine the adaptability of existing designs to the Dyna-Soar flight control subsystem electronics and new designs required. This testing will be accomplished on individual breadboard items to determine the characteristics and subsystem requirements. Data collected will be used as a base line in testing of breadboard as a complete subsystem and for modifying of the electronic components.

Test Articles/Outline:

COMPLETED 5-1-61

Test Facilities: Minneapolis-Honeywell Development Laboratory

Schedule:



EWA(s) No. (Subcontract)

This Test Supports - Breadboard Development Tests, Test Brief #S2

Date Data Req'd: 5-1-61

Flow Time ~~(EWA Rel. to Compl.)~~ Development Period ▭ Test Period ▭

1.3.1.1 GLIDER FLIGHT CONTROL - FLIGHT CONTROL SYSTEM ELECTRONICS Minneapolis-Honeywell Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 82 Responsible Company: Minneapolis-Honeywell

Test Title: BREADBOARD EVALUATION

Test Objective/Justification: These tests will provide data necessary for evaluating a complete breadboard subsystem. This testing may require use of complete flight geometry simulation. The entire electronic subsystem will be subjected to all possible performance requirements and combination of such requirements to ascertain electrical-mechanical compatibility of all modes of operation and to determine if changes are required before prototype fabrication. The data will also be used as a base line for prototype testing.

COMPLETED 9-1-61

Test Articles/Outline: Minimum requirement will be a breadboard of the flight control system electronics.

Test Facilities: Minneapolis-Honeywell Development Laboratory

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. (Subcontract)

This Test Supports - Prototype Development Tests, Test #33.

Date Data Req'd: 9-1-61

Flow Time ~~(EWA Rel. to Compl.)~~ Development Period ____ Test Period ▨

1.3.1.1 GLIDER FLIGHT CONTROL - FLIGHT CONTROL SYSTEM ELECTRONICS - Minneapolis-Honeywell Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 93 Responsible Company: Minneapolis-Honeywell

Test Title: **PROTOTYPE EVALUATION**

Test Objective/Justification: **These tests will provide data necessary for evaluating a complete prototype FCSE subsystem. This testing will be accomplished (1) on an open-loop basis to determine complete functional capability both with and without selected environmental conditions, and (2) on a closed-loop basis (airplane dynamics simulated) to determine the FCSE capability for accommodating different flight conditions. The results of this testing will establish the nature of, and requirement for, any design changes prior to qualification testing and production of the FCSE.**

Test Articles/Outline: **One complete prototype FCSE will be required. This will include one (1) computer, two (2) mode selector packages, three (3) rate gyro sensor packages and one (1) accelerometer sensor package.**

Examples of circuitry and components to be evaluated include: miniature gyros and accelerometers, various types of toggle and rotary switches, miniature servo-motor-gear-differential transducer assemblies, magnetic amplifier and transistor circuitry, relay and diode switching logic, etc.

Voltages and frequencies will include: 115V 400 cps, 26V 400 cps, 28V dc, 75 cps (low voltage gyro torquing signal), 1600 pulse/second (gyro spin motor rotation detector.)

Test Facilities: **Minneapolis-Honeywell Development Laboratory**

Schedule:

EWA(s) No. (Subcontract)

This Test Supports - Final Engineering Drawing Release for FCSE Subsystems

Date Data Req'd: 11-1-62

Flow Time - ~~(EWA Rel. to Compl.)~~ Development Period ▭ Test Period ▨

1.3.1.2 GLIDER FLIGHT CONTROL - MANUAL CONTROL - Hydraulic Power Servo System	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: ELECTRO-HYDRAULIC SERVO VALVE PERFORMANCE TEST

Test Objective/Justification: The purpose of these tests is evaluation of Electro-Hydraulic Servo Valves to determine their operational characteristics, reliability, and high temperature operational capability.

These tests are required because of insufficient information on high temperature operation and reliability of electro-hydraulic servo valves.

Test Articles/Outline: Articles to be evaluated are different types of servo valves. These components will be off-the-shelf items. Tests will emphasize reliability, performance, and compatibility in a Dyna-Soar environment.

Test Facilities: Mechanical Propulsion Laboratory, Annex "D", and the Environmental Test Laboratory, 2.01 Building.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-098

This Test Supports - Start of Hydraulic Valve Assembly Manufacturing

Date Data Req'd: 2-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1
Revised 9-11-61

1.3.1.2 GLIDER FLIGHT CONTROL - MANUAL CONTROL - Hydraulic Power Servo System	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: POWER SERVO BREADBOARD TESTS

Test Objective/Justification: To determine design requirements of the servo system, switching transients when changing from primary to secondary servo valve operation will be investigated. Also to be determined are the effects of structural deflections, surface loads, and electronic designs. Emphasis will be placed on performance, reliability, and compatibility with the stability augmentation system and the manual flight control system.

Test Articles/Outline: A servo breadboard package, including dual servo valves (with third-stage power valve connected to a dual tandem actuator), electrical and mechanical feedback devices, failure monitoring and switching devices, will be used to simulate system operation.

Test Facilities: Mechanical Propulsion Laboratory, Annex "D", and in 2.01 building.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-110 and 3-173

This Test Supports - Selection of prototype servo components

Date Data Req'd: 4-27-62

Flow Time (EWA Rel. to Compl.) ____ Test Period ____

REV 3-27-2

1.3.1.2 GLIDER FLIGHT CONTROL - MANUAL CONTROL - Hydraulic Power Servo System	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: CONTROLS DEVELOPMENT TEST PROGRAM

Test Objective/Justification: To gather data to design and develop a side arm controller and rudder pedals for pilot control of the glider and air vehicle. Data obtained will include, but not be limited to, information on dynamic and static balance, breakout forces, damping, pivot locations, fail-safety of transducers, and effects of high "g" loading.

Sufficient data is unavailable for the type of pilot's controls to be used for hypersonic vehicles. This data is needed before a suitable design can be determined.

Test Articles/Outline: (1) Sidearm controller with variable pivot points which will include the following: transducers, switches, dampers, springs, bearings, and linkages. (2) Sidearm controllers with fixed pivot points containing the same elements as (1) above. (3) Rudder pedals with required transducers and switches.

A variable pivot sidearm controller and a set of rudder pedals will be fabricated for test on the fixed-base simulator and the centrifuge [1]. Design parameters will be varied and their effects upon the operation of the controller will be noted. High "g" effects will be determined from the centrifuge tests. The data obtained from these tests will be used to design a fixed pivot sidearm controller, which will be further tested on the fixed-base simulator and the centrifuge [1]. This test data will be evaluated and the final design configuration will be determined.

[1] This is part of the Dyna-Soar Integrated Flight Simulator Program. See D2-5697-16, Volume I, Appendix A.

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-203

This Test Supports - Design & Manufacturing of Flight Article Controller

Date Data Req'd: 2-15-62

Flow Time (EWA Rel. to Compl.) ——— Test Period ▨▨▨▨▨▨▨▨

3-29-62
Revised

1.3.1.2 GLIDER FLIGHT Control - Reaction Control Hydrogen Peroxide System	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company:

Test Title: PROPELLANT LINES INSTALLATION, CLAMPING & INSULATION DEVELOPMENT - REACTION CONTROL, HYDROGEN PEROXIDE

Test Objective/Justification: The test objective is to evaluate the reaction control system propellant lines installation, clamping, and insulation methods. It is required that flow lines be provided in the glider for propellant that must be maintained at low temperatures compared to clamping structures and other heat sources. Relative movements of propellant lines and structures must be considered under the temperature & vibration environments in the glider. Penetration of the water wall by flow lines must also be evaluated.

Test Articles/Outline: The propellant flow lines & clamps which are under development will be supported by hot & cold structure fixtures which are designed to simulate movements of the structures in the glider. The test equipment will provide heat inputs to the test items which simulate ground operating (ready launch) conditions & flight temperature environments to check insulation effectiveness & structural integrity. The tubing fittings & clamping techniques will be evaluated in vibration tests utilizing temperature environments where required. Included in the tests will be verification of the integrity of the methods used to penetrate the water wall with flow lines.

Test Facilities:
1) Mechanical Propulsion Laboratory - Requires power sources capable of heating simulated structures to 1300°F.
2) Vibration Laboratory - Requires capability to vibrate tubing components while attached to structure fixtures at 1300°F.

Schedule:

[illegible] 1962												[illegible] 1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-510

This Test Supports - Reaction Control Propellant Flow Lines Installation

Date Data Req'd: 8-20-62

Flow Time (EWA Rel. to Compl.) ▭ **Test Period** ▭

RF 3-29-62

FORM 2-6181-1-1

1.3.1.2 GLIDER FLIGHT CONTROL - MANUAL CONTROL - Reaction Control Power Component	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: DISTRIBUTION LINE FITTING TESTS

Test Objective/Justification: Determine the best configuration for hot gas distribution line fittings. Tubing and fitting temperatures as high as 1800° F. can occur in service. Testing to establish a fitting configuration with suitable leakage characteristics, vibration endurance, temperature cycling characteristics, proof and burst pressures, and connect and reconnect characteristics is necessary.

Insufficient information is available to justify use of off-the-shelf fittings for high temperature applications.

-Cancelled-
Reaction Control changed to a hydrogen peroxide system.

Test Articles/Outline: Fittings developed and fabricated by vendors will be procured. The fittings will be modified into test samples with a short piece of tubing attached.

Pressurized fluid pressure (250 psia) and temperature (1800° F. maximum) will be duplicated. Hydrogen will be used as the pressurizing fluid. Leakage will be measured during the testing.

Test Facilities: Shuffleton Jet Laboratory. Test requires use of high temperature hydrogen.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No 3-191

This Test Supports - Selection of Hot Gas Distribution Line Fittings

Date Data Req'd: 4-1-62

Flow Time (EWA Rel. to Compl.) ——— Test Period ▨▨▨▨▨▨

REV 3-29-62

FORM 2-6181-1-1
Revised:

1.3.1.2 GLIDER FLIGHT CONTROL -
MANUAL CONTROL - Reaction Control
~~Power Component~~ Hydrogen Peroxide

Responsible Company:
Thompson-Ramo-Woolridge

REACTION CONTROL, HYDROGEN PEROXIDE SYSTEM

Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

Vendor test plans are to be submitted to Boeing 90 days after contract award.

1.3.3.1 PRIMARY GUIDANCE - INERTIAL GUIDANCE - Minneapolis-Honeywell Development

Responsible Company: Minneapolis-Honeywell

Test Title: INERTIAL GUIDANCE SYSTEM DESIGN DEVELOPMENT TESTS

The associate contractor, Minneapolis-Honeywell, is conducting design development tests in this area. Test planning will not be included in this document.

1.3.3.2 PRIMARY GUIDANCE - SECONDARY ATTITUDE REFERENCE - Minneapolis-Honeywell Development

Responsible Company: Minneapolis-Honeywell

Test Title: SECONDARY ATTITUDE REFERENCE SYSTEM DESIGN DEVELOPMENT TESTS

The associate contractor, Minneapolis-Honeywell, is conducting design development tests in this area. Test planning will not be included in this document.

CANCELLED - The Secondary Attitude Reference System is not a part of the Titan III Backup Guidance Configuration.

1.3.3.2 PRIMARY GUIDANCE - Secondary (Backup) Guidance	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: PILOT SAFETY SUBSYSTEM (Backup Guidance)

Test Objective/Justification: The configuration of the Pilot Safety Subsystem has not been finalized as of 3-23-62.

Test planning will be documented herein upon SPO concurrence of the Backup Guidance Configuration. Presentation of the proposed system will be made to the SPO approximately 1 April 1962.

Test Articles/Outline:

Test Facilities:

Schedule:

* Anticipated Test Schedule

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-151 (Not Released)

This Test Supports - _____

_____ Date Data Req'd: 8-30-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

128

FORM 2-6181-1-1

REV

1.3.5.1 GLIDER FLIGHT INSTRUMENTATION-
COCKPIT INDICATOR DISPLAYS-Subcontractor Development

Responsible Company:
Unknown

TEST TITLE: COCKPIT INDICATOR DISPLAYS DEVELOPMENT

Subcontractor design development testing is anticipated in this area. The test plans will be included when available.

Indicator Displays currently scheduled for implementation on Dyna-Soar are shown below. Also, the respective suppliers are indicated.

1. Energy Management Display- General Precision Incorporated (GPL Division) Pleasantville, New York.

2. Attitude-Director Indicator-Lear Corp., Grand Rapids, Michigan

3. Rate of Climb Indicator-Kollsman Corp., Long Island, New York
4.
4. Side Slip Indicator-Kollsman Corp., Long Island, New York

5. Angle of Attack Indicator-Kollsman Corp., Long Island, New York

6. Altitude Indicator-Huyck, Huntington Station, New York

7, Velocity Indicator-Huyck, Huntington Station, New York

8. Velocity Error Indicator-Huyck, Huntington Station, New York [1]

9. Thermal Monitor Display-Requirements are not firm, supplier not selected.

[1] -DELETED - Per ECM B02-0030-37, dated 3-7-62, Titan III redirection eliminated Radio Guidance System thus eliminating the requirements for Radio-Inertial Velocity comparison.

1.3.5.1 GLIDER FLIGHT INSTRUMENTATION - COCKPIT INDICATOR DISPLAYS - Boeing Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: ENERGY MANAGEMENT DISPLAY - FLIGHT INTEGRATOR MODE PERFORMANCE

Test Objective/Justification: The purpose of this test is to determine the adequacy and suitability of the Flight Integrator mode for the Energy Management Display. The following data are to be obtained: (1) Human tracking performances using the Flight Integrator mode, (2) Overlay sequencing performance during normal Dyna-Soar trajectories, (3) Sequencing performance for manual overlay operation, (4) Optimum arrangement of Flight Integrator overlays and Energy Management overlays, (5) Logic circuitry parameters for satisfactory cathode-ray tube - Flight Integrator performance, and (6) Dyna-Soar flight dynamic characteristics using Flight Integrator.

The use of the Flight Integrator mode in the Energy Management Display is desirable from a theoretical view but the adequacy and practical useability of this mode must be proven by testing.

Test Articles/Outline: The item to be tested is the pre-prototype Energy Management Display Indicator equipped with a pre-prototype Flight Integrator mode.

The output of an analog computer simulating a wide range of Dyna-Soar trajectories will be connected through suitable signal conditioning equipment to the Energy Management Display Indicator equipped with a pre-prototype Flight Integrator mode. The ability of the human to absorb the Flight Integrator information presented and perform necessary actions will be noted. Vehicle dynamic performance in response to human action based on the Flight Integrator will be evaluated. Sufficiently wide ranges of angle-of-attack, load-factor, altitude, and altitude-rate input signals will be simulated to evaluate the overlays, sprocket drive, resistors, capacitors, et al, selected for the Flight Integrator. Deviations from acceptable performance will be noted; the equipment will be adjusted to rectify the deficiencies and the tests rerun.

Test Facilities: Boeing Physics Technology Laboratory, 2.01 Building, Seattle. Test conditions will be non-hazardous. Ambient environmental conditions will be used. Analog computer services are required. Precision AC and DC power sources will be required.

Schedule: Preliminary Report 12-31-61
Final Report 4-15-62

COMPLETED 2-1-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-677

This Test Supports - Avionic Flight Instrument Design and Procurement

Date Data Req'd: (See Schedule)

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.5.1 GLIDER FLIGHT INSTRUMENTATION - COCKPIT INDICATOR DISPLAYS - Boeing Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: ENERGY MANAGEMENT DISPLAY - LANDING MODE PERFORMANCE

Test Objective/Justification: The purpose of this test is to determine the suitability and adequacy of the Landing Mode for the Energy Management Display. The following data are to be obtained: (1) Human tracking performance using the Landing Mode, (2) Visual adequacy of the landing ellipse on the cathode-ray tube, (3) Visual adequacy of the landing slash on the cathode-ray tube, (4) Display performance during transition from Energy Management overlays to Landing Mode display, (5) Technical accuracy of landing area ellipse and landing slash, (6) Logic circuitry and servo parameters for satisfactory cathode-ray tube Landing Mode performance, and (7) Dyna-Soar flight dynamic characteristics using Landing Mode.

COMPLETED 3-15-62

Test Articles/Outline: The item to be tested is the pre-prototype Energy Management Display Indicator equipped with a pre-prototype Landing Mode.

The output of an analog computer simulating a wide range of Dyna-Soar transition and landing trajectories will be connected through suitable signal conditioning equipment to the Energy Management Display Indicator equipped with a pre-prototype Landing Mode. The ability of the human to absorb and track the Landing Mode information presented will be noted. A sufficiently wide range of glider dynamics will be simulated to evaluate the performance of the landing-ellipse servo, logic circuitry, resistors, capacitors, et al, selected for the Landing Mode. Deviations from acceptable performance will be noted; the equipment will be adjusted to rectify any deficiencies and the test rerun.

Test Facilities: Boeing Physics Technology Laboratories, 2.01 Building, Seattle. Test conditions will be non-hazardous. Ambient environmental conditions will be used. Analog computer services are required. Precision AC and DC power sources will be required.

Schedule: Design 10-1-61 Report 4-15-62
Fabrication 12-31-61

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 2-022

This Test Supports - Avionic Flight Instrument Design and Procurement

Date Data Req'd: (See Schedule)

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.5.1 GLIDER FLIGHT INSTRUMENTATION - COCKPIT INDICATOR DISPLAYS - Boeing Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: ENERGY MANAGEMENT DISPLAY - BOOST MODE PERFORMANCE

Test Objective/Justification: The purpose of this test is to determine the adequacy and suitability of the Boost Mode for the Energy Management Dismlay. The following data are to be obtained: (1) Human tracking performance using the Boost Mode, (2) Overlay sequencing performance during normal Dyna-Soar trajectories, (3) Sequencing performance for manual overlay operation, (4) Optimum arrangement of Boost Mode overlays and Energy Management overlays, (5) Logic circuitry parameters for satisfactory cathode-ray tube - Boost Mode performance, and (6) Dyna-Soar flight dynamic characteristics using Boost Mode.

COMPLETED 3-15-62

Test Articles/Outline: The item to be tested is the pre-prototype Energy Management Display Indicator equipped with a pre-prototype Boost Mode.

The output of an analog computer simulating a wide range of Dyna-Soar trajectories will be connected through suitable signal conditioning equipment to the Energy Management Display Indicator equipped with a pre-prototype Boost Mode. The ability of the human to absorb the Boost Mode information presented and perform necessary actions will be noted. Vehicle dynamic performance in response to human action based on the Boost Mode information will be evaluated. Sufficiently wide ranges of angle-of-attack, load-factor, altitude, and altitude-rate input signals will be simulated to evaluate the overlays, sprocket drive, resistors, capacitors, et al, selected for the Boost Mode. Deviations from acceptable performance will be noted; the equipment will be adjusted to rectify the deficiencies and the tests rerun.

Test Facilities: Boeing Physics Technology Laboratories, 2.01 Building, Seattle. Test conditions will be non-hazardous. Ambient environmental conditions will be used. Analog computer services are required. Precision AC and DC power sources will be required.

Schedule: Preliminary Report 12-31-61
Final Report 4-15-61

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-027

This Test Supports - Avionic Flight Instrument Design and Procurement

Date Data Req'd: (See Schedule)

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

REJ 3-27-62

1.3.5.2 GLIDER FLIGHT INSTRUMENTATION - Separation Sequence Programmer & Converter, Signal Data	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: BREADBOARD DEVELOPMENT TESTING - SEPARATION SEQUENCE PROGRAMMER

Test Objective/Justification: The purposes of these tests are to: (1) determine component suitability, (2) develop reliable circuits, (3) establish design configuration, and (4) prove compliance of the integrated assembly with the performance requirements.

These tests are essential to the design effort and to ensure the ability of the hardware item to fulfill the requirements.

Test Articles/Outline: The following types of circuits will be tested and evaluated:

1. Squib firing circuits; relay type and solid state type.
2. Solid state timing circuits, short and long time interval.
3. Voltage level sensing and operating circuits.
4. Pulse amplitude and period sensing and operating circuits.

The components will be electrically and environmentally tested to ensure their suitability for the hardware item. The integrated circuitry will be tested for proper functioning with simulated loads and input signals. Alternate methods, if developed, will be tested for comparison.

Test Facilities: Engineering Laboratory Support Shops, 2.01 Building, Seattle. (2-4080 Shop Directed by Design)

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(.) No. 3-249

This Test Supports - Release of Final Electrical Schematic

Date Data Req'd: 5-15-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.5.2 GLIDER FLIGHT INSTRU-MENTATION - Separation Sequence Programmer & Signal Data Converter	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: ENVIRONMENTAL TESTING OF PROTOTYPE SEPARATION SEQUENCE PROGRAMMER

Test Objective/Justification: The purpose of this test is to ensure that the Separation Sequence Programmer design is both mechanically and electrically capable of withstanding the expected glider environments.

The environmental testing required to ensure satisfactory equipment operation will be dependent upon the design which is evolved.

Data obtained from these tests will either prove satisfactory equipment operation or form a basis for a design change to obtain such operation. Adequate Records will be maintained and the final phase of testing will serve as qualification of the Separation Sequence Programmer for flight usage. No production hardware will be subjected to a Qualification Test (Ref. Para. 1.3.8.2, Test Brief #2, D2-5697-16, Vol. IV). 1

Test Articles/Outline: An Engineering prototype of the Separation Sequence Programmer will be subjected to the anticipated glider environment conditions. Equipment operation will be monitored during the tests to provide sufficient data to ensure design compatibility with glider environments.

The environmental parameter levels for vibration, mechanical shock and acceleration tests are set forth in D2-7481, Appendix "A", "Electronics Packaging Requirements - Contract Procured Flight Equipment". Test requirements for temperature, altitude, and other parameters are documented in Boeing Specification D2-80267.

Test Facilities: Boeing Environmental Test Laboratory, 2.01 Building, Seattle. No additional facilities will be required.

Schedule:
Final Electrical Schematic Avail: 5-15-62
Prototype Hardware Avail for Test: 8-7-62
Hardware Qualification Complete: 10-7-62 1

EWA(s) No. (8-022)

This Test Supports - Engineering Final Assembly Dwg. Release to Manufacturing

Date Data Req'd: 10-15-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.5.2 GLIDER FLIGHT INSTRUMENTATION - Separation Sequence Programmer, Signal Data Converter	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: BREADBOARD DEVELOPMENT TESTS - SIGNAL DATA CONVERTER

Test Objective/Justification: The purposes of these tests are to: (1) determine component suitability, (2) prove circuit techniques, (3) prove alternate method configurations, and (4) prepare auxialiar test circuitry.

These tests are essential for companion with the design and to obtain confidence in the ability of the hardware to meet requirements.

Test Articles/Outline: Electronic circuits from simple, single-function circuits to more complex shift registers will be tested to prove design techniques. Alternate methods, if developed, will be tested for comparison. If component problems arise, those components will be tested as a part of this program.

Test Facilities: Engineering Laboratory Support Shops, 2.01 Bldg. Seattle

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-241

This Test Supports - Release of Preliminary Electrical Schematic

Date Data Req'd: 5-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.5.2 GLIDER FLIGHT INSTRUMENTATION-Separation Sequence Programmer and Signal Data Converter	DESIGN DEVELOPMENT TEST PLAN	Brief No.
		Responsible Company: Boeing

Test Title: INTERFACE COMPATIBILITY TEST-Signal Data Converter

Test Objective/Justification: The purpose of these tests is to establish the Signal Data Converter's ability to eliminate incompatible interfaces.

The principal interfaces are between the Signal Data Converter and (1) airborne digital computer, (2) pilot's displays, and (3) telemeter system.

These tests are necessary to prove design techniques and establish confidence in the Signal Data Converter.

Test Articles/Outline: The airborne computer (Verdan) will be addressed by a breadboard Signal Data Converter. Information, in binary coded pulses, are directed out of the data line of the Verdan at a 330 KC rate. The Signal Converter will then be directed, by means of a fixed program, to channel data to the proper register. From the Signal Converter registers, the information is either converted to an analog signal for use in the displays or directed to the telemeter system at a much reduced clock rate (2Kc).

The displays will be observed to ensure that their operation via the Signal Data Converter is consistent with the display requirements.

The Verdan will be addressed in varying patterns to obtain response times, reliable switching modes, and to obtain verification of the validity of the design approach.

Test Facilities: Engineering Shops, 2.01 Building, Seattle. A Verdan computer will be required.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-241

This Test Supports - Release of Final Electrical Schematic

Date Data Req'd: 7-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.3.5.2 GLIDER FLIGHT INSTRUMENTATION - Separation Sequence Programmer and Signal Data Converter	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: ENVIRONMENTAL TESTING OF PROTOTYPE SIGNAL DATA CONVERTER

Test Objective/Justification: The purpose of this test is to ensure that the Signal Data Converter design is both mechanically and electrically capable of withstanding the expected glider environments.

The environmental testing required to ensure satisfactory equipment operation will depend on the design which is evolved.

Data obtained from these tests will either prove satisfactory equipment operation or form the basis for a design change to obtain such results. Adequate Records will be maintained and the final phase of testing will serve as qualification of the Signal Data Converter for flight usage. No production hardware will be subjected to a Qualification Test (Ref. para. 1.3.8.2, Test Brief #1, D2-5697-16, Vol. IV). 1

Test Articles/Outline: An engineering prototype of the Signal Data Converter will be subjected to the anticipated glider environmental conditions. Equipment operation will be monitored during the tests to provide sufficient data to ensure design compatibility with glider environments.

The environmental parameter levels for vibration, mechanical shock and acceleration tests are set forth in D2-7481, Appendix "A", "Electronics Packaging Requirements - Contract Procured Flight Equipment". Test requirements for temperature, altitude, and other parameters are documented in Boeing Specification D2-80269.

Test Facilities: Boeing Environmental Test Laboratory, 2.01 Building, Seattle. No additional facilities will be required.

Schedule:

Final Electrical Schematic Avail: 7-1-62
Prototype Hardware Avail for Test: 9-10-62
Hardware Qualification Complete: 11-10-62 1

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. (8-216)

This Test Supports - Engineering Final Assembly Dwg. Release to Manufacturing.

Date Data Req'd: 12-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.5.2 GLIDER FLIGHT INSTRUMENTATION - Separation Sequence Programmer & Signal Data Converter	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: Boeing

Test Title: CIRCUIT RELIABILITY TEST - SIGNAL CONVERTER BREADBOARD

Test Objective/Justification: The purpose of these tests are to uncover and eliminate trouble areas in the Signal Converter breadboard concurrent with prototype testing.

Because of accelerated schedules, it will not be possible to extensively test the Signal Converter breadboard prior to releasing engineering drawings. Therefore, this testing must be accomplished concurrent with prototype testing. This testing must be done on the breadboard model because electrical access to all parts of the prototype Signal Converter will not be possible.

NOTE: Testing to demonstrate Reliability (MTBF) will not be done on Dyna-Soar

Test Articles/Outline: The article to be tested is a breadboard Signal Converter.

The Signal Converter breadboard will be subjected to electrical noise. Various modes of operation will be examined to discover the Signal Converter's susceptibility to random noise spikes on the power supplies, ground lines, and various inputs, outputs.

Meantime between failure tests will be conducted. The cause of failures will be isolated and corrective action taken.

Additional tests as may suggest themselves will be undertaken as time permits.

Breadboard test setups will evolve as part of the design effort and will be available for these tests.

Test Facilities: Boeing Engineering Laboratory Shops, 2.01 Building, Seattle.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-241

This Test Supports - Release of Final Drawings to Manufacturing

Date Data Req'd: 12-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1

Rev 3-29-62

1.3.5.3 GLIDER FLIGHT INSTRUMENTATION
Malfunction Detection

Responsible Company

Test Title: MALFUNCTION DETECTION SYSTEMS

Malfunction detection development is being accomplished as an integral part of the subsystems requiring malfunction detection; these systems give a warning only to the pilot. No separate malfunction detection system development testing is anticipated.

611

1.3.6.1 COMMUNICATIONS AND DATA LINK - RCA Development

Responsible Company: RCA

Test Title: COMMUNICATIONS AND TRACKING SUBSYSTEMS - DESIGN DEVELOPMENT TESTS

The associate contractor, RCA, Camden, New Jersey, is conducting design development testing in this area. Test planning will not be included in this document.

3 27-62

1.3.7.1 ANTENNAS AND TRANSMISSION LINES - Propagation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: PROPAGATION (EFFECTS OF IONIZATION)

Test Objective/Justification: Voltage breakdown data in a plasma environment are required for both antenna design purposes and power level considerations for the Dyna-Soar vehicle transmitting equipments. Test is required since this data is not presently available.

COMPLETED
7-2[illegible]-61

Test Articles/Outline: X-band dielectric-filled aperture antennas will be tested at Boeing in radio frequency discharge plasmas using both CW and pulsed signal test conditions.

Breakdown powers are measured in simulated Dyna-Soar environments of altitudes of 300,000 feet and plasma having electron densities to 10^{11} electrons/cm^3.

Tests to be conducted at Stanford Research Institute are similar to those at Boeing except that a thermally generated plasma is being utilized at Stanford rather than the radio frequency discharge plasma. These tests are being conducted under limited high altitude conditions in thermal plasma having electron densities to 5×10^{11} electrons/cm^3 and temperatures to 2500° K.

Test Facilities: At Boeing, the tests are being conducted in existing facilities; the main components include the altitude chamber, associated vacuum pumps, radio frequency transmitters.

Similar facilities are used at SRI, with the addition of equipment used to generate thermal plasma.

Schedule:

	1961												1962											
7/60	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 4-017 (4-001) Communications Equipment Design Criteria

This Test Supports - [illegible]

Date Data Req'd: 10-1-60

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭ Test Period ▨▨▨▨▨

BAC 1545 - 83

4-3-1-62

1.3.7.1 ANTENNAS AND TRANSMISSION LINES - Propagation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: PROPAGATION (EFFECTS OF IONIZATION) - HYPERSONIC WIND TUNNEL TESTS

Test Objective/Justification: These tests are cross-referenced here for completeness. See Section 1.1.1.1 GLIDER AIRFRAME - AERODYNAMIC DEVELOPMENT, AEROTHERMODYNAMICS, Test Briefs Nos. 2-9 and 2-10. [1]

Note: Flow separation data obtained from vehicle (Glider and 2nd Stage Booster) flow field tests at Arnold Center, tunnel "B" during November 1961 (Ref. para. 1.6.1.8, Test Brief 2-1) were used to calculate effects of ionization. Other tests referenced above have not been scheduled to date, pending evaluation of tunnel facility capabilities.

Test Articles/Outline:

[1] These tests have been CANCELLED.
3-25-62

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: DETERMINATION OF ELECTRICAL CHARACTERISTICS OF HIGH TEMPERATURE DIELECTRIC MATERIALS

Test Objective/Justification: These tests will provide electrical characteristic data (loss tangents and dielectric constants) for the subject dielectric materials to aid in material and selection for the Dyna-Soar high temperature antennas and transmission lines.

COMPLETED 8-31-61

Test Articles/Outline: A disc-shaped specimen of each of several dielectric materials will be tested in X-band cavity dielectrometers at temperatures of 500° F. to 2500° F. The dielectric constant and loss tangent will then be calculated from the data obtained.

Test Facilities: Physics Technology Laboratories, Boeing, Seattle

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 4-031

This Test Supports - Final Material Selection and Development of Attachment Techniques

Date Data Req'd: Dec. 1, 1961

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No.2 Responsible Company: Boeing

Test Title: ANTENNA PATTERN MEASUREMENTS

Test Objective/Justification: Objective of these tests is to provide antenna radiation contours for glider azimuth and elevation angles. This data will be used to verify analytical methods used to establish communication and tracking system capabilities and to establish optimum glider antenna locations.

COMPLETED 2-1-62

Test Articles/Outline: Full size and scaled circular waveguid aperture antennas will be mounted in a scaled model of the Dyna-Soar glider or in flat ground planes as required. The antenna/mockup assembly will be mounted on a support tower on the Antenna Pattern Range. The model is located in the field of a pattern range directional antenna which transmits an amplitude modulated signal at the appropriate frequency. The pattern range console controls the orientation of the model and records relative spatial energy distribution (radiation patterns).

Test Facilities: Boeing Antenna Pattern Ranges

Schedule: (1) SEE TB NO. 8, PAGE 169.1

10/60 1961 | 1962

J F M A M J J A S O N D J F M A M J J A S O N D

EWA(s) No. 4-031 (3-390) (1)

This Test Supports - Completion of the Antenna and Transmission Line Developmental Prototypes

Date Data Req'd: March 30, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: ANTENNA IMPEDANCE TESTS

Test Objective/Justification: Data is required to extend our present knowledge and the state-of-the-art on the electrical properties of high temperature dielectrics and metals, their means of attachment and bonding, their physical characteristics (such as dimensional stability), and the effects of these items on antenna impedance characteristics and subsequent design.

Test Articles/Outline: Impedance will be measured on antennas constructed of conventional materials and antennas constructed of high temperature dielectrics and metals mounted to representative glider skin panels, appropriate RF signal generators, directional couplers and detectors, and VSWR indicators. High temperature impedance measurements will be made in a high temperature anechoic chamber. Properties will be measured at prescribed frequencies over the temperature range specified for various antenna locations on the glider as required.

Test Facilities: Boeing High Temperature Anechoic Chamber, Physics Technology Laboratory.

Schedule: 1 SEE TB NO. 8, PAGE 169.1

10/60 1961 | 1962

J F M A M J J A S O N D | J F M A M J J A S O N D

EWA(s) No. 4-031 (3-390) 1

This Test Supports - Completion of the Antenna and Transmission Line Developmental Prototypes

Date Data Req'd: May 30, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: Boeing

Test Title: **ANTENNA RF COUPLING MEASUREMENTS**

Test Objective/Justification: **Data collected will aid in the determination of systems compatibility (systems interference). These tests are to provide RF energy coupling data between transmitting and receiving antennas on the Dyna-Soar glider.**

COMPLETED 2-1-62

Test Articles/Outline: **Prototype antennas for the Communications, Tracking and Remote Control Recovery Subsystems will be mounted at their proposed locations on a full scale glider section or equivalent ground plane section. Measuring equipment consists of adequate signal generators, receivers and calibrated attenuators. Coupling measurements consist of relative insertion loss measurements made with and without antennas in the test system. Coupling data will be in decibels (DB) and measurements will be made at prescribed subsystem frequencies as deemed necessary.**

Test Facilities: **Boeing Physics Technology Laboratory**

Schedule: 1 ▷ SEE TB NO. 8, PAGE 169.1

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 4-031 (3-390) 1 ▷

This Test Supports - Completion of the Antenna and Transmission Line Developmental Prototypes

Date Data Req'd: March 30, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: RF ANTENNA SYSTEM BREAKDOWN STUDY

Test Objective/Justification: Data collected will aid in the determination of antenna design parameters. The tests are to provide RF breakdown information on the transmitting antennas and transmission lines for the Dyna-Soar glider.

COMPLETED 3-15-62

Test Articles/Outline: Prototype antennas and transmission lines will be mounted in a plastic evacuation chamber. RF breakdown data will be taken at prescribed subsystem frequencies, power levels, and altitudes.

Test Facilities: Boeing Physical Technology Laboratory

Schedule: 1 ▷ SEE TB NO. 8, PAGE 169.1

10/60 1961 1962

J F M A M J J A S O N D J F M A M J J A S O N D

EWA(s) No. 4-031 (3-390)

This Test Supports - Completion of the Antenna and Transmission Line Developmental Prototypes

Date Data Req'd: March 30, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: Boeing

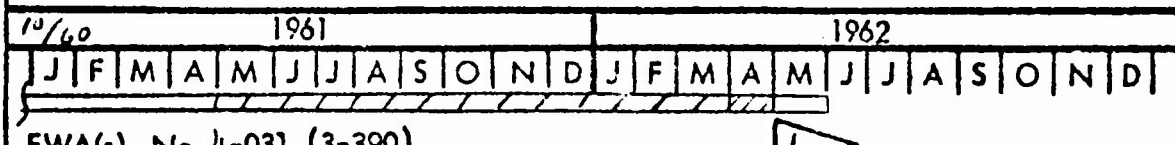
Test Title: TEMPERATURE - VIBRATION AND ACOUSTIC NOISE TESTS

Test Objective/Justification: These tests of developed antennas and transmission lines and/or parts thereof will provide information concerning fabrication techniques for, and dimensional stability of final materials for the Dyna-Soar antennas and transmission lines.

Test Articles/Outline: Antennas, transmission lines and/or parts thereof constructed from possibly suitable high temperature materials will be mounted in appropriate jigs (to be determined) and subjected to preliminary vibration, temperature and acoustic noise envelopes. Vibration, temperature and acoustic noise envelopes are to be determined.

Test Facilities: Boeing Vibration and Acoustic Laboratories

Schedule: ▷ SEE TB NO. 8, PAGE 169.1



EWA(s) No. 4-031 (3-390) ▷

This Test Supports - Completion of the Antenna and Transmission Line Developmental Prototypes

Date Data Req'd: May 30, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

1.3.7.2 ANTENNAS AND TRANSMISSION LINES - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: Boeing

Test Title: TRANSMISSION LINES IMPEDANCE AND INSERTION LOSS MEASUREMENTS

Test Objective/Justification: Data is required to aid in establishing the design for adequately transferring RF energy between the glider antennas and transmitters and/or receivers. To accomplish this it is necessary to extend the state-of-the-art on design of high temperature transmission lines. Tests will be made to determine the electrical and physical properties of high temperature dielectrics and metals. These tests will provide impedance data (reflection factors) and attenuation characteristics of transmission lines in the Dyna-Soar temperature environment.

COMPLETED 3-1-62

Test Articles/Outline: Transmission line impedance will be measured with appropriate RF signal generators, directional couplers, VSWR indicators and loads. Waveguides will be mounted in a high temperature anechoic chamber and the impedance properties measured at prescribed frequencies over the temperature range specified for the transmission line locations on the glider as deemed necessary.

Test Facilities: Physics Technology Laboratory, High Temperature Anechoic Chamber.

Schedule: 1 SEE TB NO. 8, PAGE 169.1

10/60 1961 1962

J F M A M J J A S O N D J F M A M J J A S O N D

EWA(s) No. 4-031 (3-390) 1

This Test Supports - Completion of Antenna and Transmission Line Developmental Prototypes

Date Data Req'd: March 30, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1

1.3.7.2 Antennas and Transmission Lines - Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 8 Responsible Company: Boeing

Test Title: Remote Control Recovery Antenna System Electrical Tests

Test Objective/Justification:

A recent requirement (November 1961) for a Remote Control Recovery antenna system has necessitated an extension of some development tests to support the design of such an antenna system. The required tests are described in the preceding test briefs, numbers 2, 4, 5, and 7, 3 and 6.

Test Articles/Outline:

Refer to test briefs 2, 4, 5, and 7, 3 and 6

Test Facilities:

Refer to test briefs 2, 4, 5, and 7, 3 and 6

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 4-031 (3-390)

This Test Supports - Design Release of the Remote Control Recovery Antenna System

Date Data Req'd: June 13, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.3.7.2 Antenna & Transmission Lines--Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 9 Responsible Company: Boeing

Test Title: Gas Leakage Tests Across Waveguide Flanges (C-band & X-band waveguide systems)

Test Objective/Justification: The objective of these tests is to determine the gas leakage rate across the waveguide flanges.

The present waveguide system may not have the power handling capability required for the C-Band tracking system. Pressurization of the waveguide is one means of improving its power handling capabilities. Prior to pressurizing the system, leakage rates need to be determined in order that a gas supply system can be selected. The above also applies to the X-Band electronic landing system.

Test Articles/Outline:

Test articles include:

3 - 7 inch long waveguide sections with flanges
2 - blank waveguide flanges
32 - screws and washers.

The above articles will be assembled into a single unit and pressurized (5 psig) at room temperature. The loss of gas will be monitored over a period of time. The above test will be repeated in a 1200°F environment.

Test Facilities:

Boeing Environmental Labs. - 2401 Bldg. Seattle

Special equipment required: Strip chart recorders, instrumentation (4 chromel - alumel control thermocouples), etc.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-390

This Test Supports - Final Detail & Assy. Dwg. for Waveguide Systems

Date Data Req'd: 5-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1

1.3.7.2 Antennas, Windows & Feedlines	DESIGN DEVELOPMENT TEST PLAN	Brief No. 14 Responsible Company: Boeing

Test Title: CTS/AGE/Antenna Subsystem Compatibility Test Program

Test Objective/Justification: The CTS equipment, AGE, and associated antennas and waveguides will be integrated for the first time during this test. Work to be accomplished is in partial fulfillment of the Statement of Work, Paragraph B(1)1.

Test Articles/Outline: One of the major reasons for the pre-SIL compatibility tests is to tie the airborne CTS and AGE elements together for the first time, and to establish that these elements are compatible. The following equipment will be used in the test:

1 Set, CTS Airborne Equipment
1 Set, Maintenance Ground Equipment (MGE)
1 Set, Ground Checkout Equipment (GCOE)
1 Set, CTS Surface Elements as required.
1 Set, Antennas and Transmission Lines as available.
1 Set, Antenna Test Covers
2 Transmitter Equipment Racks
2 Receiver Equipment Racks
1 Test Control and Monitoring Panel
Miscellaneous Interconnection Cables

Test Facilities:

1. Communications Lab., 2.01 Building
2. RFI shielded enclosure

Schedule:

1963												1964											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-565

This Test Supports - Demonstration of Early Compatibility of CTS System.

Date Data Req'd: 1 January 1964

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Nose Cap Instrumentation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 81 Responsible Company: Chance Vought

Test Title: CHANCE VOUGHT DEVELOPED NOSE CAP INSTRUMENTATION - ELEMENTS AND MATERIALS COMPATIBILITY TESTS

Test Objective/Justification: Tests will be performed on the materials being considered for the Dyna-Soar nose cap instrumentation system with the following test objectives: (1) determine the linearity, repeatibility, hysteresis, noise level, impedance, and time constant of thermocouple pairs capable of providing a usable electrical output of 4300°F. (2) Determine the chemical compatibility, liquid temperature, thermal shock capability and time-temperature capability of thermocouple electrical insulators and sheathing materials; (3) Determine the effects of high temperature on the resistivity and formability of thermocouple electrical insulators; (4) Determine the porosity requirements, oxidation resistance, thermal shock capability, and thermal conductivity effects of thermocouple sheathing; (5) Determine the thermocouple junction-protecting sheath interface; and (6) Determine the high temperature chemical compatibility between the pressure tubing and nose cap materials.

Test Articles/Outline: Test specimens will be heated to 4300°F. with oxy-acetylene torches, propane torches, ram jets or radiant lamps. The heat source, heating rates and time-temperature history will vary depending upon the data desired during any particular test. Conventional electrical measuring equipment, optical pyrometers, two-color pyrometers, X-Y plotters and metallographic equipment will be used to obtain the desired data.

DELETED PER ENGRG CHANGE MEMO B0-2-0032 DATED FEB 13, 1962

Test Facilities: General Electric (Evandale, Ohio)
Chance Vought (Dallas, Texas)

Schedule: Final Report 5-7-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Covered by Contract

This Test Supports - Component Testing (1.4.1.1 Test Brief 83)

Date Data Req'd: 5-7-62

Flow Time (~~EWA/Ltr. to Compl.~~) Subcontract Period ▭ Test Period ▨

FORM 2-6181-1-1 4-3-29-62

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Nose Cap Instrumentation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 83 Responsible Company: Chance Vought

Test Title: CHANCE VOUGHT DEVELOPED NOSE CAP INSTRUMENTATION - COMPONENT TESTS

Test Objective/Justification: The objectives of these tests will include the following:

1. Determine the structural integrity of the nose cap pressure port and tubing installation.
2. Determine the structural integrity of the nose cap thermocouple installation.
3. Determine the transfer functions of the pressure port and thermocouple installations.

Developed test data is required to verify analytical studies and conclusions.

Test Articles/Outline: The configuration of the test specimens will be as shown in Chance Vought document AST/EIR-13421. Test specimens will be tested to 4300°F in a ram jet, propane torch or arc jet facility. The heat sources will be programmed to provide heating rates and time-temperature histories which approximate the Dyna-Soar nose cap re-entry conditions.

DELETED PER ENGRG CHANGE MEMO BO-2-0032 DATED FEB 13, 1962.

Test Facilities: The ram jet, propane torch and arc jet test facilities at the Chance Vought Corporation, Dallas, Texas, will be used for these dates.

Schedule: Final Report 6-1-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Covered by Contract

This Test Supports - Full Scale Verification Testing (1.4.1.1 Test Brief #83)

Date Data Req'd: 6-1-62

Flow Time (Subcontract Period / EWA not to Complete) — Test Period

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Nose Cap Instrumentation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 33 Responsible Company: Chance Vought

Test Title: CHANCE VOUGHT DEVELOPED NOSE CAP INSTRUMENTATION - FULL SCALE NOSE CAP VERIFICATION TESTS

Test Objective/Justification: The object of these tests is to verify that the Chance Vought developed nose cap instrumentation concept, when installed, will meet all the requirements necessary to provide accurate nose cap surface temperature and aerodynamic pressure data inputs to the Dyna-Soar Data Acquisition System.

Final verification of the nose cap instrumentation design can be assured only through test data obtained with a prototype instrumentation system installed in a full scale nose cap.

Test Articles/Outline: The configuration of the test articles and the test ~~outline will be~~ supplied at a later date.

DELETED PER ENGRG CHANGE MEMO BO-2-0032 DATED FEB 13, 1962.

Test Facilities: Chance Vought Test Facilities, Dallas, Texas

Schedule: Final Report 11-1-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Covered by Contract

This Test Supports - Final Drawing Releases for Instrumented Nose Cap

Date Data Req'd: 11-1-62

Flow Time (~~EWA rec. to compl.~~ Subcontract Period) ▭ Test Period ▨

154

1.4.1.1 AIRBORNE DATA COLLECTION - TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. S4 Responsible Company: Advanced Technology Lab.

Test Title: SURFACE TEMPERATURE TRANSDUCER SYSTEM - LEAD WIRE DEVELOPMENT

Test Objective/Justification: The object of these tests would be to evaluate the performance of the particular type of lead wire selected to be used with the 3000° F. surface temperature transducer system.

Since airborne temperature measurements of this magnitude under Dyna-Soar re-entry conditions is currently beyond the state-of-the-art, extreme care and considerable developmental effort must be used in the selection of thermocouple materials for this application. Lead wire problems will arise which are not common to those of the more conventional materials used for measurement of lower temperatures. The feasibility of the proposed configuration thus has to be demonstrated.

COMPLETED
7-15-61

Test Articles/Outline: Test samples will consist of various lengths (5 to 20 feet) of thermocouple transducer cable.

The transducer cable will be subjected to the anticipated Dyna-Soar thermal environment. The effects on the insulation resistance, change in flexibility (aging effects) of the wire, change in thermoelectric signal output from the sensor, etc. will be determined.

Test Facilities: Tests will be performed at Advanced Technology Laboratories, Inc. facilities at Mountain View, California

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079/3-259 (Subcontract)

This Test Supports - Development of Compatible Lead Wire for Sensor System

Date Data Req'd: 10-15-61

Flow Time (EWA Rel. to Compl.) ____ Test Period ____

FORM 2-6181-1-1 A-13-29-62

1.4.1.1 AIRBORNE DATA COLLECTION - TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. S5 Responsible Company: Advanced Technology Lab.

Test Title: SURFACE TEMPERATURE TRANSDUCER SYSTEM - SENSOR MATERIALS AND FABRICATION TESTS

Test Objective/Justification: The objectives of these tests are to determine the materials and configurations of the sensor head.

Use of an airborne sensor to measure temperatures of the magnitudes expected in the Dyna-Soar environment is beyond the current state-of-the-art and therefore requires considerable developmental effort to produce a workable system. Tests are necessary to prove the workability of the concept.

COMPLETED
7-1-61

Test Articles/Outline: Test samples will be small ceramic insulated thermocouples, cylindrical in shape, and designed for installation in hollow rivets. The test specimens will be subjected to temperatures of up to 3000° F. in oxidizing environments through use of flame or arc plasma facilities.

Test Facilities: Test facilities will be located in the Advanced Technology Laboratories, Inc. at Mountain View, California

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079/3-259 (Subcontract)

This Test Supports - Transducer System Design Verification Tests (TB-8)

Date Data Req'd: 7-1-61

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION - TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. S6 Responsible Company: Advanced Technology Lab.

Test Title: SURFACE TEMPERATURE TRANSDUCER SYSTEM - ENVIRONMENTAL HUMIDITY TESTS

Test Objective/ Justification: The objective of this test will be to determine the most feasible method of protecting the thermocouple system from the deleterious effects of a high humidity environment.

Thermocouple installations of the type proposed are particularly susceptible to degradation resulting from moisture absorption. For the system to function properly, it must be protected or sealed against moisture.

COMPLETED
7-1-61

Test Articles/ Outline: Test articles will consist of the sensor and its associated lead wires or cable.

The transducer system will be subjected to an environment of up to 100 percent relative humidity. Its operational performance will be checked during and after exposure to this environment.

Test Facilities: Advanced Technology Laboratories, Inc., Mountain View, California

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079/3-259 (Subcontract)

This Test Supports - Transducer System Design Verification Tests (TP#8)

Date Data Req'd: 7-1-61

Flow Time (EWA Rel. to Compl.) ____ Test Period ////////

1.4.1.1 AIRBORNE DATA COLLECTION - TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. S7 Responsible Company: Advanced Technology Lab.

Test Title: SURFACE TEMPERATURE TRANSDUCER SYSTEM - THERMOCOUPLE REFERENCE JUNCTION COMPENSATOR TESTS

Test Objective/Justification: The objective of this test is to determine the feasibility of the reference junction compensating equipment.

The temperature of the thermocouple reference junction located in the equipment compartment of the Dyna-Soar vehicle will vary in an uncontrolled manner and this would introduce errors into surface temperature measurement. Therefore, a method must be devised and tested which will compensate for this variation and eliminate such errors and thus increase the accuracy of the flight data.

COMPLETED
7-15-61

Test Articles/Outline: The article to be tested is a reference junction compensator unit.

The article will be subjected to the varying extremes of the vehicle equipment compartment and its performance will be monitored and adjusted to meet the design objective.

Test Facilities: Advanced Technology Laboratories, Inc., Mountain View, California

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079/3-259 (Subcontract)

This Test Supports - Transducer System Design Verification Tests (TE8)

Date Data Req'd: 8-1-61

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

3-29-62

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1.4.1.1 AIRBORNE DATA COLLECTION - TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. S8 Responsible Company: Advanced Technology Lab.

Test Title: SURFACE TEMPERATURE TRANSDUCER SYSTEM - SENSOR ATTACHMENT TESTS

Test Objective/Justification: The objective of this test is to determine the feasibility of the method of attaching the sensor to the vehicle skin.

The attachment of this particular sensor presents a unique installation problem and its performance under Dyna-Soar environmental conditions cannot be accurately predicted. Actual tests are thus necessary to prove the concept.

COMPLETED 4-30-61

NOTE. SEE TEST BRIEF S9

Test Articles/Outline: A test specimen will consist of a model of the sensor attached to a sample of the vehicle skin. (A sample of vehicle skin was supplied by Boeing.)

Specimens will be subjected to various conditions of shock, vibration and acceleration as well as thermal shock to give assurance that the design will meet the requirements of anticipated flight conditions.

Test Facilities: Advanced Technology Laboratories, Inc., Mountain View, California

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079/3-259 (Subcontract) Delivery of Prototype Sensors to Boeing.

This Test Supports -

Date Data Req'd: 3-15-62

Flow Time (EWA Rel. to Compl.) Test Period

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. S9
		Responsible Company: Advanced Tech. Lab.

Test Title: SURFACE TEMPERATURE TRANSDUCER SYSTEM - REDESIGN TESTS

Test Objective/Justification: The results of the tests described on test brief number S8 have made it necessary for Boeing to redirect the development efforts of the ATL subcontractor. Tests have shown that the thermocouple wire used in the development effort to date, embrittles under repeated temperature cycling. The redesign effort involves testing and evaluating thermocouple materials such as the alloys of tungsten rhenium and combinations of platinum and rhodium, and substituting the most promising such materials combination into the current design configuration.

Test Articles/Outline: The type of test activity to be conducted during this redesign effort parallels that described in test briefs S4 thru S6. The modified transducers installed in typical Molybdenum heat shield panels will be subjected to Design Verification tests similar to those encountered during a qualification test program (i.e., Hot and Cold vibrati tests, static acceleration, low temp. environment, humidity, and thermal shock). ATL's developmental subcontract will terminate with delivery of prototype transducers, system design, installation instructions, and tooling during April 1962 (Ref. Boeing specification document D2-8015).

NOTE: See also, TB #'s 5 & 6, pages 182 & 183.

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. (Subcontract, funded via EWA 3-259)

This Test Supports - Delivery of 3000°F Prototype Temperature Transducer Systems

Date Data Req'd: April 15, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Nose Cap Instrumentation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: BOEING DEVELOPED NOSE CAP INSTRUMENTATION - ELEMENTS AND MATERIALS COMPATIBILITY TESTS

Test Objective/Justification: The objectives of these tests are to determine the chemical and electrical compatibility of the materials being considered for the construction of an instrumented nose cap.

Insufficient knowledge or data is available in the field of materials compatibility at the high temperatures expected on the nose cap during a Dyna-Soar re-entry.

Test Articles/Outline: Test specimens will primarily consist of small (approximately 3 in. dia. x 1/2 in. thick) molded zirconia blocks in which are embedded samples of the materials under consideration for the development of a thermocouple capable of measuring temperatures to 4300°F under Dyna-Soar re-entry conditions.

These specimens will be heated in an NRC vacuum oven to 4300°F. after which metallographic and/or X-ray analysis will be performed to determine chemical compatibility. Resistivity tests at temperatures to 4300°F. will also be made. Thermocouples, fabricated from materials exhibiting compatible chemical characteristics, will then be installed in zirconia specimens and tested to 4300°F. to determine the sensivitity, repeatibility and hysteresis characteristics of the thermocouple.

Test Facilities: Boeing Instrumentation Development Laboratories. No additional facilities or equipment will be required.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-169

This Test Supports - Component Testing (1.4.1.1 Test Brief 2)

Date Data Req'd: 4-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Nose Cap Instrumentation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: BOEING DEVELOPED NOSE CAP INSTRUMENTATION - COMPONENT TESTS

Test Objective/Justification: The object of these tests is to determine the behavior of the nose cap surface temperature sensors and pressure ports when subjected to Dyna-Soar re-entry temperature profiles.

These tests are necessary to verify analytical studies.

Test Articles/Outline: Three-inch zirconia test specimens with thermocouples and pressure ports will be instrumented and tested in the oxy-acetylene torch facility and the Plasma-Jet facility to obtain preliminary data. The heat sources will be programmed to provide heating rates and time-temperature histories which approximate the Dyna-Soar nose cap re-entry conditions. Instrumented eight-inch test specimens will be tested in the same facilities to obtain data which cannot be obtained on the less expensive cylindrical test specimens because of variables associated with the spherical contour of the nose cap.

Test Facilities: Boeing Oxy-Acetylene Torch Facility and the Boeing 1MW Plasma-Jet Facility.

Schedule: Preliminary Design Report 11-16-61
Test Complete 6-1-62

EWA(s) No. 3-169

This Test Supports - Full Scale Verification Testing (1.4.1.1 Test Brief 3)

Date Data Req'd: 6-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Nose Cap Instrumentation	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: BOEING DEVELOPED NOSE CAP INSTRUMENTATION - FULL SCALE NOSE CAP VERIFICATION TESTS

Test Objective/Justification: The large number of variables associated with an instrumented nose cap precludes the extrapolation of component test data to verify the design of the nose cap instrumentation system. Final verification that accurate nose cap surface temperature and aerodynamic pressure data inputs will be supplied to the Dyna-Soar Data Acquisition System can be assured only through test data obtained with a prototype instrumentation system installed in a full scale nose cap.

Test Articles/Outline: An instrumented full scale nose cap containing a prototype of the surface temperature and aerodynamic pressure sensing system will be tested in a rocket test facility which has been programmed and calibrated to provide heating rates and time-temperature histories approximating those of a Dyna-Soar re-entry.

NOTE: Test conditions will be within the capabilities of hardware developed for EWA 5-697 and 5-610. If the test program proceeds on a timely basis, the test fixtures and nose cap developed under the above EWA's may be utilized.

Test Facilities: Boeing Rocket Test Facility

Schedule: Test Complete 6-1-62
Final Report 7-1-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-169

This Test Supports - Final Drawing Released for Instrumented Nose Cap

Date Data Req'd: 7-1-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION - TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: Boeing

Test Title: HIGH TEMPERATURE THERMOCOUPLE WIRE TESTS

Test Objective/Justification: The object of these tests is to evaluate the performance of various types of thermocouple lead wire or cable when subjected to the high temperature (2000° F.) environment similar to that expected during Dyna-Soar re-entry conditions.

Knowledge and data presently available on high temperature thermocouple wire is insufficient to determine or predict their behavior in the Dyna-Soar re-entry environment.

COMPLETED 12-1-61

Test Articles/Outline: Test specimens consisting of various lengths (5 to 20 feet) of sheathed thermocouple cable will be heated in an oven to temperatures of up to 2000° F. Measurements of insulation resistance variation, extraneous signal (open circuit) output, signal errors due to common mode voltages, and sensor output voltages will be made. Examination and analyses of the materials will be made at the conclusion of the heat tests to determine degradation effects, if any, on the materials.

Test Facilities: Boeing Instrument Development Laboratories and Structures Laboratories.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079 (3-259)

This Test Supports - Final Drawing Release for Instrumented Glider Structure

Date Data Req'd: 9-10-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: TEMPERATURE SENSOR INSTALLATION COMPATIBILITY TESTS - EXTERNAL TO THE ENVIRONMENTALLY CONTROLLED COMPARTMENTS

Test Objective/Justification: This test is necessary to determine that the sensor* installation is feasible and that the installation of this sensor will not adversely affect the structural integrity of the vehicle.

Test Articles/Outline: Test specimens consisting of sensors (or physical replicas thereof) mounted in sample structural skin panels will be subjected to the vibration and thermal conditions specified for the Dyna-Soar environment. At the conclusion of the tests the specimens will be subjected to detailed examination for structural failure and for operational failure of the sensor.

* Transducer prototypes developed by the Advanced Technology Laboratories (Ref. TBs #84 thru 89) will be subjected to design verification tests by Boeing. These tests will consist of both mechanical and electrical tests necessary to verify the adequacy of the ATL transducer design (See Schedule below).

Test Facilities: Boeing Structures Environmental Laboratories and Structures Laboratories

Schedule: (1) In-house development tests, 10-1-61 thru 3-30-62.
(2) Verification of ATL prototypes, 3-30-62 thru 5-10-62 *

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079/3-259

This Test Supports - Final drawing release for instrumented glider structure.

Date Data Req'd: 9-10-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: Boeing

Test Title: TEMPERATURE SENSOR RESPONSE TESTS

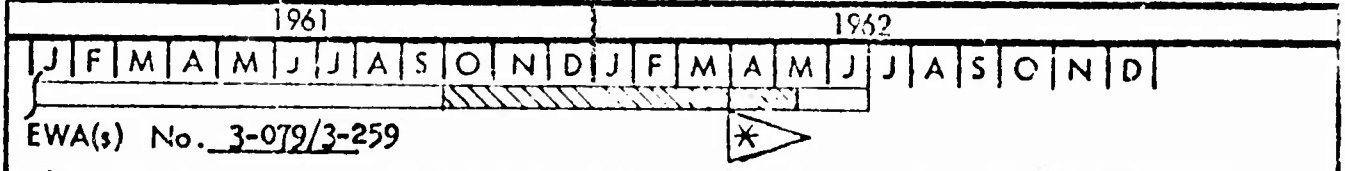
Test Objective/Justification: This test is necessary to determine that the sensor* will provide accurate, usable flight data when used in the Dyna-Soar vehicle. Due to the complexity of the variables which affect the response of the sensor, such response cannot be adequately predicted analytically.

Test Articles/Outline: A test specimen consisting of a temperature sensor mounted in a small sample section of the vehicle skin will be heated to 2500 to 3000°F. Temperature of the specimen panel will be monitored by radiometric means. The transducer system output will be simultaneously monitored. From the data obtained, the transducer response time, accuracy, and thermal perturbation effects will be determined.

* Transducer prototypes developed by the Advanced Technology Laboratories (Ref. TBs #S4 thru S9) will be subjected to design verification tests by Boeing. These tests will consist of both mechanical and electrical tests necessary to verify the adequacy of the ATL transducer design (See schedule below).

Test Facilities: Boeing Instrument Development Laboratory and Structures Environmental Laboratory.

Schedule: (1) In-house developments tests, 10-1-61 thru 3-30-62.
(2) Verification of ATL prototypes, 3-30-62 thru 5-10-62 *



EWA(s) No. 3-079/3-259

This Test Supports - Final Drawing Release for Instrumented Glider Structure.

Date Data Req'd: 9-10-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: Boeing

Test Title: TECHNICAL AREA - UNIQUE TRANSDUCERS - HEAT FLUX

Test Objective/Justification: The objectives of these tests are to support the development and performance evaluation of an aerodynamic heat flux transducer. The transducer is being developed for the Dyna-Soar data acquisition system.

CANCELLED
3-29-62

Test Articles/Outline: Test program can be divided into three phases:

1. Search for acceptable materials and fabrication processes. These tests will include the measurements of emissivity and thermo conductivity of both high emissivity and low emissivity materials. Various high temperature adhesives will be studied in the laboratory to evaluate mechanical properties and fabrication techniques.
2. Fabrication of a special heat source to be used in the development.
3. Fabrication and test of breadboard sensors incorporating materials and fabrication processes studied in No. 1. above.

Test Facilities: Boeing Physics Technology Laboratory, Seattle, Washington

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-079 & 4-049

This Test Supports: Decision to incorporate either Ultra-Violet Densitometers or Heat Flux Transducers on D-S

Date Data Req'd: Mar. 15, 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

16 Apr 62 3-16-62

1.4.1.1 AIRBORNE DATA COLLECTION-TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 8 Responsible Company: Boeing

Test Title: PRESSURE TRANSDUCER DEVELOPMENT

Test Objective/Justification: Measurement of aerodynamic pressure at selected points on the surface of the vehicle is required. The principle problems associated with aerodynamic pressure measurement involve a tradeoff between time response and tubing length and tubing diameter.

Note: These tests are in support of aerodynamic pressure transducer system design. Tests to determine pressure tubing disconnect configuration are shown on Brief #11, Page 187.1.

Test Articles/Outline: Investigative studies of the transient response of the pressure measuring system will be made. These studies will include the effects of tubing lengths and diameters, port configurations and coupling methods.

Tests to be conducted include the following:

1. Tests to determine pressure wave phase lag and pressure amplitude attenuation for various tubing lengths and diameters. The parameters varied in these tests are frequency of the applied sinusoidal pressure wave and pressure.
2. Tests to determine optimum orifice configuration, tube diameters, and minimum bend radii.
3. Tests to determine thermal transpiration errors.
4. Tests to determine outgassing of the pressure tube at low pressures.

Test Facilities: System Test Department
Development Laboratory,
Boeing, Seattle

Physics Technology
Development Laboratory,
Boeing, Seattle

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 6-038

This Test Supports - Installation Criteria

Date Data Req'd: 5-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1 3-27-62

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 9 Responsible Company: Boeing

Test Title: TRANSDUCER DEVELOPMENT TESTS (Off-the-Shelf and Vendor Modified Hardware)

Test Objective/Justification: The capability of standard or modified off-the-shelf transducers to meet a specific set of performance requirements is not always predictable from information available in sales brochures, charts, and literature, nor are performance requirements always predictable when the physical and/or operating characteristics have been modified to meet a particular application. Therefore, it is anticipated that certain tests will be required at Boeing to ascertain the suitability of purchased transducers to meet Dyna-Soar requirements.

Test Articles/Outline: Purchased transducers as deemed necessary by Boeing will be tested to the extent required to ascertain their ability to meet Dyna-Soar applications. Operating characteristics will be observed under expected installation environments and modifications as deemed necessary will be incorporated.

Test Facilities: Boeing System Test Development Lab, 2.01 Bldg., Seattle, with support of Environmental Labs.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 6-038

This Test Supports - Installation Criteria

Date Data Req'd: 7-3-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 10 Responsible Company: Boeing

Test Title: ENVIRONMENTAL TESTING - ENVIRONMENTALLY CONTROLLED COMPARTMENT TRANSDUCER INSTALLATIONS

Test Objective/Justification: The purpose of this test is to ensure that the installation designs for transducers located in the pilot's and equipment compartments are mechanically capable of withstanding the expected glider environmental conditions. In addition, the installation designs must be such that transducer operation is not impaired during flight due to the installation.

The development testing required to ensure the adequacy of any particular installation design will be dependent upon the design which is evolved and the type of transducer which is to be mounted.

Data obtained from these tests will either prove satisfactory installation design or form the basis for a design change to obtain a satisfactory installation.

Test Articles/Outline: Engineering prototypes of the subject transducer installations will be subjected to the anticipated glider environmental conditions. Transducer operation will be monitored during the tests to ensure compatibility with the installation design.

The environmental parameter levels for vibration and acceleration tests are set forth in D2-7481, Appendix "A", "Electronics Packaging Requirements - Contract Procured Flight Equipment." Test requirements for temperature and altitude have not yet been documented.

CANCELLED: Transducer installation testing is no longer deemed necessary per Electronics Design Engineering Organization.

Test Facilities: Boeing Environmental Test Laboratory, 2.01 Building, Seattle. No additional facilities will be required.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-085

This Test Supports - Final Engineering Dwg. Releases to Manufacturing

Date Data Req'd: July 20, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 11 Responsible Company: Boeing

Test Title: AERO-PRESSURE DISCONNECT DEVELOPMENT

Test Objective/Justification:

Measurement of aerodynamic pressure at selected points on the surface of the vehicle is required. The centralized location of the transducers necessitates the development of a disconnect to provide a break in the pressure tubing near the surface port. This is in order to facilitate initial construction and permit ready refurbishment of skin panels. There is also a requirement to test for suitability various tubing materials which affect this disconnect design.

Note: Tests to determine aerodynamic pressure transducer system design are shown in Brief #8, Page 185.

Test Articles/Outline:

Specimens of several types will be subjected to suitable tests at room temperatures and at 1800°F, both with and without vibration to determine connector strength under tension and torsion, resistance at temperature, air leakage, and materials compatibility. The prototypes designed and fabricated as a result of these development tests will be subjected to similar qualification tests.

Test Facilities:

Boeing Environmental Test Laboratory, 2.01 Building, Seattle. No additional facilities will be required.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
												▨	▨	▨	▨	▨							

EWA(s) No. 3-421

This Test Supports - Installation Criteria

Date Data Req'd: 5-30-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 AIRBORNE DATA COLLECTION TRANSDUCERS - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 12 Responsible Company: Boeing

Test Title: **TECHNICAL AREA - UNIQUE TRANSDUCERS - AIR DENSITY**

Test Objective/Justification: **The objectives of these tests are to support the development of an air density transducer (ultra-violet densitometer) for use on the Dyna-Soar vehicle. This development utilizes some new components and specialized electro-optical designs.**

CANCELLED
3-29-62

Test Articles/Outline: **Tests will consist of the following:**

1. Evaluation and study of special components. An experimental program will be undertaken to study the performance of the following special components: UV light source, detector, switch, etc. Both the component and mode of operation will be studied.
2. Fabrication and evaluation of major subassemblies.
   a. Transmitter
   b. Receiver
   c. Electronics
   d. Etc.
3. Evaluation of the breadboard transducer system.
4. Development and evaluation of special laboratory facilities.

Test Facilities: **Boeing Physics Technology Laboratory, Seattle, Washington**

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 4-050

This Test Supports - Decision to incorporate either Ultra-Violet Densitometers or Heat Flux Transducers on DS. Date Data Req'd: Mar. 15, 1962

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.1 Airborne Data Collection Transducers - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 13 Responsible Company: Boeing

Test Title: Performance Tests; Flutter Transducer

Test Objective/Justification: The objectives of these tests will be to obtain a device which is capable of making flutter measurements on the Dyna-Soar glider while operating in temperature environments of approximately 1700°F. Current "state-of-the-art" devices for making flutter and vibration measurements are limited to operating temperatures of approximately 500°F and analyses have shown that encapsulating and cooling such a device is impractical for the intended Dyna-Soar application. Flutter measurements are required for design verification and failure isolation.

Test Articles/Outline: Test article will consist of a flutter vibrometer which has been developed by the Boeing Structures Technology Department. This device consists essentially of a miniature machined metal cantilever beam attached to a mounting block. A single strain gage is mounted on the beam near the mounting block to sense the motion imparted to the beam.

Engineering test parts will be fabricated using various methods of bonding the strain gage to the beam. The test part will be mounted on a special vibration table and enclosed in an oven in which temperatures up to 1750°F will be maintained. Amplitude and frequency calibration data will be obtained at these elevated temperatures to determine the optimum fabrication techniques and performance characteristics.

Test Facilities: Boeing Structural Dynamics Laboratory

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-447 (Not Released)

This Test Supports - Final Drawing Release for Instrumented Glider Structure

Date Data Req'd: 12-30-62

Flow Time (EWA Rel. to Compl.) ☐——— Test Period ▨▨▨

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: EMR

Test Title: PCM-FM Multiplex Feasibility Tests

Test Objective/Justification:

The objectives of these tests are to determine if the FM translation method, and PCM-FM multiplex is feasible with the present state-of-the-art equipment.

COMPLETED 12-1-61

Test Articles/Outline:

The articles to be tested include a composite FM system, a simulated PCM system and a mixer set.

The following tests will be performed: interchannel crosstalk, inter modulation distortion, optimum channel specing, preemphasis, maximum channel capability, effects of environmental variations.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Breadboard Development Test, Test Brief #3, 5, &9

Communications - Test Instrumentation Subsystem Simulation Tests, Test Brief #2.

Date Data Req'd: 12/1/61

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S2 Responsible Company: EMR

Test Title: Communications - Test Instrumentation Subsystem Simulation Tests

Test Objective/Justification:

The objectives of these tests are to: ensure a satisfactory system performance of the DS-I, Air Ground communications and data link, ensure compatibility between the communication and data processing equipment, provide information as to the optimum settings of certain adjustments, and to point out possible design shortcomings or limitations and investigate their remedies.

COMPLETED 2-15-62

Test Articles/Outline:

The articles to be tested include a breadboard FM set, simulated PCM set, mixer set, modulator, transmitter, attenuator, preamplifier, receiver, carrier discriminators, filters, and subcarrier discriminators.

The following tests will be made: optimum preemphasis, cross-modulation effects, and signal-to-noise ratio measurements.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Prototype Development Tests, Test Brief #4, 6, & 10

Date Data Req'd: 2/16/62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

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PAGE 188.1

13-AUG-27-62

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 93 Responsible Company: EMR

Test Title: **Breadboard Development Tests - PCM Conversion Set**

Test Objective/Justification:

The objectives of these tests are to insure that the breadboard set will fulfill the functional purpose for which it was designed. In general, the individual units making up the set will be tested separately. The whole set of units will be assembled and the assembly tested to insure that function and accuracy specifications are met.

COMPLETED 12-1-61

Test Articles/Outline:

The articles to be tested include the programmer, analog-to-digital converter, basic commutator, low level subcommutators, high level subcommutators, and power supplies.

The complete breadboard set will be subjected to the following tests: temperature, input impedance, common mode rejection, over voltage crosstalk and recovery time, signal output amplitude, pulse duration, pulse rise time, pulse jitter, spectrum analysis, accuracy, and electrical power performance. The successful breadboard configuration will be electrically representative of the first prototype set.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Prototype Development Tests, Test brief #4

Date Data Req'd: 12/1/61

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S 4 Responsible Company: EIR

Test Title: Prototype Development Tests - PCM Conversion Set

Test Objective/Justification:

The objectives of these tests are to insure that the prototype set, when assembled into a system along with the other prototype sets, will be capable of passing the system Qualification tests.

Test Articles/Outline:

The article to be tested will be a Prototype PCM Conversion Set. The set will be subjected to both performance and environmental tests as called out in Source Control Drawing 10-81003 (Conversion and Storage Equipment - Test Instrumentation Subsystem, Glider). The final prototype configuration will be subjected to Qualification Tests.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Final Assembly Drawing Release

Date Data Req'd: 5/1/62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

12-4-2-22-62

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S 5 Responsible Company: EMR

Test Title: **Breadboard Development Tests - FM Conversion Set**

Test Objective/Justification:

The objectives of these tests are to insure that the breadboard set will fulfill the functional purpose for which it was designed. In general, the individual units making up the set will be tested separately. The whole set of units will be assembled and the assembly tested to insure that function and accuracy specifications are met.

COMPLETED 12-1-61

Test Articles/Outline:

The articles to be tested include the subcarrier oscillators, carrier oscillators, translator and FM conversion set power supply.

The complete breadboard set will be subjected to the following tests: temperature, input impedance, common mode rejection, interchannel crosstalk and over voltage limiting, signal output amplitude, frequency spectrum, accuracy, and electrical power performance. The successful breadboard configuration will be electrically representative of the first prototype set.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - **Prototype Development Tests, Test Brief #6**

Date Data Req'd: **12/1/61**

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S 6 Responsible Company: EMR

Test Title: **Prototype Development - FM Conversion Set**

Test Objective/Justification:

The objectives of these tests are to insure that the prototype set, when assembled into a system along with the other prototype sets, will be capable of passing the system Qualification Tests.

Test Articles/Outline:

The article to be tested will be a prototype FM Conversion Set. The set will be subjected to both performance and environmental tests as called out in Source Control Drawing 10-81003 (Conversion and Storage Equipment - Test Instrumentation Subsystem, Glider). The final prototype configuration will be subjected to Qualification Tests.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - **Final Assembly Drawing Release**

Date Data Req'd: 5/1/62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

3-27-62

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 37 Responsible Company: EMR

Test Title: **Breadboard Development Tests - Time Code Generator Set**

Test Objective/Justification:

The objectives of these tests are to insure that the breadboard set will fulfill the functional purpose for which it was designed. In general, the individual units making up the set will be tested separately. The whole set of units will be assembled and the assembly tested to insure that function and accuracy specifications are met.

COMPLETED 12-1-61

Test Articles/Outline:

The articles to be tested include the precision oscillator, programmer logic, accumulators, scanner, encoder, and power supply.

The completed breadboard set will be subjected to the following tests: temperature, command pulse test, signal output amplitude and rise time, accuracy test, and electrical power performance.

The successful breadboard configuration will be electrically representative of the first prototype set.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Prototype Development Tests, Test Brief #8

Date Data Req'd: 12/1/61

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

NE 3-29-62

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 68 Responsible Company: EMR

Test Title: **Prototype Development Tests - Time Code Generator Set**

Test Objective/Justification:

The objectives of these tests are to insure that the prototype set, when assembled into a system along with the other prototype sets, will be capable of passing the system Qualification Tests.

COMPLETED 3-29-62

Test Articles/Outline:

The article to be tested will be a prototype Time Code Generator Set. The set will be subjected to both performance and environmental tests as called out in Source Control Drawing 10-81003, (Conversion and Storage Equipment - Test Instrumentation, Glider). The final prototype configuration will be subjected to Qualification Tests.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - **Final Assembly Drawing Release**

Date Data Req'd: **4/1/62**

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1

REV 3-24-62

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. 59 Responsible Company: EMR

Test Title: Breadboard Development Tests - Mixer Set

Test Objective/Justification:

The objectives of these tests are to insure that the breadboard set will fulfill the functional purpose for which it was designed. In general, the individual units making up the set will be tested separately. The whole set of units will be assembled and the assembly tested to insure that function and accuracy specifications are met.

COMPLETED 12-1-61

Test Articles/Outline:

The article to be tested include the preamplifier and output amplifiers.

The complete breadboard set will be subjected to the following tests: temperature, signal output amplitude, frequency response, output impedance, output isolation, and electrical power performance. The successful breadboard configuration will be electrically representative of the first prototype set.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Prototype Development Tests, Test Brief #10

Date Data Req'd: 12/1/61

Flow Time (EWA Rel. to Compl.) ▭▭▭▭▭ Test Period ▨▨▨▨▨

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S10 Responsible Company: EMR

Test Title: **Prototype Development Tests - Mixer Set**

Test Objective/Justification:

The objectives of these tests are to insure that the prototype set, when assembled into a system along with the other prototype sets, will be capable of passing the system Qualification Tests.

Test Articles/Outline:

The article to be tested will be a prototype Mixer Set. The set will be subjected to both performance and environmental tests as stated in Source Control Drawing 10-81003 (Conversion and Storage Equipment - Test Instrumentation Subsystem, Glider). The final prototype configuration will be subjected to Qualification Tests.

Test Facilities:

EMR Development Laboratories, Sarasota, Florida.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - **Final Assembly Drawing Release**

Date Data Req'd: 5/1/62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

3-29-62

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S11 Responsible Company: EMR

Test Title: Breadboard Development Tests - Data Tape Recorder Set

Test Objective/Justification:

The objectives of these tests are to insure that the breadboard set will fulfill the functional purpose for which it was designed. In general, the individual units making up the set will be tested separately. The whole set of units will be assembled and the assembly tested to insure that function and accuracy specifications are met.

COMPLETED 2-1-62

Test Articles/Outline:

The articles to be tested include the tape transport, record head assembly, and record amplifiers.

The complete breadboard set will be subjected to the following tests: temperature, input impedance, remote control functions, monitor signal, accuracy, and electrical power performance.

The successful breadboard configuration will be representative of the first prototype set.

Test Facilities:

Ampex Military Products Company, Redwood City, California.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - Prototype Development Test, Test Brief #12

Date Data Req'd: 2/1/62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem EMR Development	DESIGN DEVELOPMENT TEST PLAN	Brief No. S12 Responsible Company: EMR

Test Title: **Prototype Development Tests - Data Tape Recorder Set**

Test Objective/Justification:

The objectives of these tests are to insure that the prototype set, when assembled into a system along with the other prototype sets, will be capable of passing the system Qualification Tests.

Test Articles/Outline:

The article to be tested will be a prototype Data Tape Recorder Set and will be subjected to both performance and environmental tests as called out in Source Control Drawing 10-81003 (Conversion and Storage Equipment - Test Instrumentation Subsystem, Glider). The final prototype will be subjected to Qualification tests.

Test Facilities:

Ampex Military Products Company, Redwood City, California.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. Subcontract

This Test Supports - **Final Assembly Drawing Release**

Date Data Req'd: 5/1/62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

AS-REV 3-29-62

1.4.1.2 AIRBORNE DATA COLLECTION - TEST INSTRUMENTATION SUBSYSTEM - Miscellaneous	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: PATCH BOARD DEVELOPMENT TESTS

Test Objective/Justification: A programmed airborne patch panel is required for use in the Dyna-Soar glider during air and ground launch programs. An Amp Incorporated Model "240" Airborne Lightweight patch panel assembly will be tested to determine if a preprogrammable plug board type patch panel can withstand the Dyna-Soar environment and meet the interface requirements presented by Dyna-Soar subsystems.

COMPLETED 10-1-61

Test Articles/Outline: The tests to be performed are described in D2-5055-1, "Test Instrumentation Subsystem Design Procurement Specification," paragraphs 4.3.5.7.1 (Vibration Tests), 4.3.5.7.5 (Acceleration), and 4.3.5.7.6 (Shock). During these tests, the patch panel shall be wired and patched using sufficient contacts and representative signals to determine whether satisfactory operation is achievable, i.e., no signal contacts are broken or no noise generated which will exceed 0.5 percent of signal level. Tests should be completed by Sept. 15, 1961.

Test Facilities: Boeing Systems Test Department Development Laboratories, 2.01 Building, Seattle.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 6-035

This Test Supports - Dyna-Soar Patch Panel Development

Date Data Req'd: Oct. 1, 1961

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: BOEING

Test Title:

Signal Conditioner Design Development Testing

Test Objective/Justification:

Signal Conditioners are required in most applications to adapt transducer outputs to the PCM and FM Conversion Sets. Some of these Signal Conditioner detail requirements will not be known in time to purchase units from outside sources and will consequently have to be designed and fabricated at Boeing. The total types and quantities that fall into this category cannot be established until designs are further defined. Investigative and verification testing of these conditioning circuit designs will have to be conducted.

Test Articles/Outline:

Breadboard circuits of Boeing designed Signal Conditioners will be tested to investigate and verify their capability to adapt specific transducer outputs to meet the input requirements of the PCM or FM Conversion Sets. Tests on the breadboard signal conditioners will continue beyond the final electrical schematic release.

Test Facilities:

Boeing Systems Test Development Lab 2.01 Bldg.

Schedule: Preliminary Schematic Release 4-16-62
Final Schematic Release 10-12-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 6-038

This Test Supports - Schematic release

Date Data Req'd: 10-12-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.2 AIRBORNE DATA COLLECTION-Test Instrumentation Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: SIGNAL CONDITIONER DEVELOPMENT TESTS (Off-the-Shelf and Vendor Modified Hardware)

Test Objective/Justification: The capability of signal conditioners to meet a specific set of performance requirements is not always predictable from information available in sales brochures, charts, and literature, nor are performance requirements always predictable when the physical packaging and/or operating characteristics have been modified to meet a particular application. Therefore, it is anticipated that a certain amount of testing will be required at Boeing to ascertain the suitability of purchased signal conditioners to meet Dyna-Soar requirements.

Test Articles/Outline: Purchased Signal Conditioners as deemed necessary by Boeing will be tested to the extent required to ascertain their ability to meet Dyna-Soar applications. The signal conditioners will be subjected to simulated transducer outputs to verify the signal conditioners' capability to adapt specific transducer outputs to meet the input requirements of the PCM or FM Conversion sets.

Test Facilities: Boeing Systems Test Development Lab, 2.01 Bldg., Seattle, with support of Environmental Labs.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 6-038

This Test Supports - Installation Criteria

Date Data Req'd: 10-12-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.2 AIRBORNE DATA COLLECTION Test Instrumentation Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4
		Responsible Company: Boeing

Test Title: ENVIRONMENTAL TESTING OF PROTOTYPE SIGNAL CONDITIONING CIRCUITRY PACKAGES

Test Objective/Justification: The purpose of this test is to ensure that the signal conditioning circuitry package designs are both mechanically and electrically capable of withstanding the expected glider environments.

The environmental testing required to ensure satisfactory equipment operation will depend on the individual package designs which are evolved.

Data obtained from these tests will either prove satisfactory equipment operation or form a basis for a design change to obtain satisfactory operation. Adequate Records will be maintained and the final phase of testing will serve as qualification of the Signal Conditioning Circuitry Packages for flight usage. No production hardware will be subjected to a Qualification Test (Ref. para. 1.4.1.2, Test Brief #2, D2-5697-16, Vol. IV).

Test Articles/Outline: These tests will be conducted on the engineering prototypes of the signal conditioning circuitry packages. The number of test articles will depend upon the structural similarity of the individual package designs which are evolved. The following additional equipment will be required:

1. Test Fixtures
2. Electrical test equipment

Engineering prototypes of the signal conditioning circuitry packages will be subjected to the anticipated glider environmental conditions. Equipment operation shall be monitored during the tests to provide sufficient data to ensure design compatibility with glider environments.

The environmental parameter levels for vibration, mechanical shock and acceleration tests are set forth in D2-7481, Appendix "A", "Electronics Packaging Requirements - Contract Procured Flight Equipment". Test require-

Test Facilities: ments for temperature & altitude have not yet been documented.

Boeing Environmental Test Laboratory, 2.01 Building, Seattle.
No additional facilities will be required.

Schedule:
Final Electrical Schematic Avail: 7-1-62
Prototype Hardware Avail for Test: 8-15-62
Hardware Qualification Complete: 11-30-62

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. (8-017)

This Test Supports - Engineering Final Assembly Dwg. Releases to Manufacturing.

Date Data Req'd: 12-21-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

FORM 2-6181-1-1

1.4.1.2 Airborne Data Collection Test Instrumentation Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: BOEING

Test Title: Signal Conditioner & Transducer Installation Development Testing

Test Objective/Justification:

Transducers installed with their specific Signal Conditioners in many cases may pick up undesirable noise by the virtue of their installation environment. These conditions are not always predictable in advance; hence, transducer and conditioner installations must be tested in order to add appropriate filters to eliminate the objectionable noise.

Test Articles/Outline:

Simulated or actual transducer - Signal Conditioner installations will be tested in order to determine the amount of noise introduced into the Test Instrumentation Subsystem by the installed environment. Environment as used here is in reference to electrical environment and not necessarily physical environment such as temperature and pressure. All installations will be evaluated from the standpoint of susceptibility to noise and all those considered susceptible will be tested.

Test Facilities:

Boeing Systems Test Development Lab 2.01 Bldg.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 6-038

This Test Supports - Installation Criteria

Date Data Req'd: 12-28-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.4.1.2 AIRBORNE DATA COLLECTION Test Instrumentation Subsystem	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: The Boeing Company

Test Title: Environmental Test of 104 pin Airborn Connector

Test Objective/Justification: After completion of a 90 day test, the connectors shall exhibit contact resistances no greater than an equivalent length of No. 22 wire under voltages of 5 mv and 5 v and the insulation resistance shall be greater than 10^9 ohms when operating in a 160°F ambient temperature environment.

The connectors and contacts are used in the patch panel, composed of low leval thermocouple circuits, some of which, operate in a "dry circuit" leval.

Test Articles/Outline: Test will consist of 2 each, series wired 104 pin connectors. Connectors are to operate at 5 v and 5 mv, open-circuit respectively. Contacts are to be crimped with an acceptable tool. Measurements of contact continuity, contact resistance and insulation resistance are to be performed several times weekly.

COMPLETED 2-1-62

Test Facilities: Test equipment will consist of items presently available in the 2-4086 Shop area i.e.

1 - oven
1 - GR megohm meter
1 - HP 425 A micro-voltmeter
1 - DC Amplifier

Schedule: Shop 2-4086 will conduct the test.
A test report will be released by 15 Feb. 1962

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-087

This Test Supports -- Structures and Installation Group

Patch Panel

Date Data Req'd: 1 Jan 62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1

REJ 3-27-62

Design Development tests in the following areas are covered in D2-6783-1, "Structural Integrity Development & Test Program - Detail Plan - Structures Technology".

1.6.1.1 Air Vehicle Design - Aerothermodynamic Development

1.6.1.2 Air Vehicle Design - External Loads Establishment

1.6.1.3 Air Vehicle Design - Dynamics Environment

1.6.1.4 Air Vehicle Design - Vibration Environment

1.6.1.5 Air Vehicle Design - Acoustics Environment

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-1 Responsible Company: Boeing

Test Title: RIGID FORCE MODEL TEST OF THE INITIAL VEHICLE CONFIGURATION * (COMPLETED)

Test Objective/Justification: This test was conducted to determine: (1) the performance and longitudinal, lateral and directional stability and control characteristics; (2) fin effectiveness; and (3) the effect of fin misalignment.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	MODEL	FACILITY	DATA REPORT(s)
134	Dec 60	7-039	AD-478I-1	Ames 11 x 11	D2-8137
134	Dec 60	7-039	AD-478I-1	Ames 9 x 7	D2-80009
134	Jan 61	7-039	AD-478I-1	Arnold VKF 'A'	D2-80020

* Glider and Titan I Booster

Test Articles/Outline:

COMPLETED
DATES AS NOTED

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-2 Responsible Company: Boeing

Test Title: RIGID FORCE MODEL TEST OF THE INTERIM VEHICLE CONFIGURATION * (COMPLETED)

Test Objective/Justification: This test was conducted to examine the performance and longitudinal, lateral and directional stability and control characteristics of the interim vehicle configuration in the transonic and supersonic speed regimes.

SPO APPROVED TEST NO.	COMPLETION DATE	EWA (Ref. Only)	MODEL	FACILITY	DATA REPORT(S)
153	5-61	7-082	AD-478I-2	Ames 11 x 11	
153	5-61	7-082	AD-478I-2	Ames 9 x 7	
153	5-61	7-082	AD-478I-2	Ames 8 x 7	
153	7-61	7-082	AD-478I-2	Arnold VKF 'A'	

*Glider and Titan II Booster

Test Articles/Outline:

COMPLETED
DATES AS NOTED

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No._____

This Test Supports - _____

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ▭▭▭ Test Period ▨▨▨

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-5 Responsible Company: Boeing

Test Title: RIGID FORCE MODEL TEST OF THE FINAL VEHICLE CONFIGURATION (SPO APPROVED TEST #135)

Test Objective/Justification: The purpose of this test is to determine: (1) the drag and base pressure; and (2) the longitudinal, lateral, and directional stability and control characteristics of the final configuration of the Dyna-Soar air vehicle at transonic, supersonic and hypersonic speeds.

The data collected from this test is required for the determination of boost performance and trajectories and for a definition of the stability of the final vehicle configuration.

[redacted]

CANCELLED - 2-22-62 due to Titan III booster redirection.

[redacted]

Test Articles/Outline: An .04 scale force model of the final vehicle configuration which may be assembled into first and second stage boost configurations will be constructed. The model will be capable of being mounted by means of an internal strain gage balance to the stings of each wind tunnel mentioned in the test schedule. Pitch data will be obtained between angles of -8° and a +10°. Yaw data will be obtained for angles between a -4° and a +10°. The Mach number ranges will be between .6 and 10. Runs will be made with the fins on and off. Pitch runs at constant yaw angle and yaw runs at constant angle-of-attack will also be included.

Test Facilities: Ames Unitary Wind Tunnel, Arnold Center "A" Tunnel, Arnold Center "B" Tunnel, Arnold Center "C" Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - The air vehicle configuration development

Date Data Req'd: 9-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-4 Responsible Company: Boeing

Test Title: GLIDER STAGE II SEPARATION TEST
(SPO APPROVED TEST #137)

Test Objective/Justification: The purpose of this test is to determine the drag and stability of both the separated booster and the glider plus transition section throughout the Mach number range of boost flight. This data will be determined for large angles-of-attack which might occur when escape separation becomes necessary. The drag data is required to determine the staging performance and to indicate the possibility of the second stage overtaking and colliding with the glider plus transition section. The stability data is required to determine the necessary control capability of the glider and the stability of the separating booster.

Test Articles/Outline: Existing force models will be modified wherever possible to perform this testing. The tests will be conducted at Mach numbers between .5 and 8.0. Data will be recorded for angles-of-attack and yaw between 0° and maximum allowable before glider escape. Various separation distances and attitudes will be tested.

CANCELLED - 2-22-62 due to Titan III booster redirection.

Test Facilities: Ames Unitary Wind Tunnel, Arnold Center "A" Tunnel, Arnold Center "B" Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - The glider and transition section configuration

_____ Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-5 Responsible Company: Boeing

Test Title: AEROELASTIC STABILITY TEST OF THE FINAL VEHICLE CONFIGURATION (SPO APPROVED TEST #136)

Test Objective/Justification: The purpose of this test is to determine (1) The aeroelastic stability of the final configuration of the Dyna-Soar boost vehicle, and (2) the effect of aeroelasticity on fin effectiveness.

The data obtained from this test is required to determine the effect of aeroelasticity on the stability of the final configuration of the Dyna-Soar boost vehicle.

Test Articles/Outline: An aeroelastic model will be constructed with a scaled mass distribution as well as a scaled external geometry of the final configuration. The scale mass distribution of the model must be flexible enough to be capable of representing the mass distribution of the actual vehicle as it varies with Mach number or time along the boost trajectory. The structural stiffness of the model will be scaled to represent the vehicle in the presence of the dynamic pressure encountered in the wind tunnel. The model will be sting mounted on a six-compartment internal strain gage balance which will record the static loads which are causing the aeroelastic deformation of the vehicle. This data will be recorded for Mach numbers between .5 and 5.0 and for angles-of-attack and yaw between -4° and +10°.

CANCELLED - 2-22-62 due to Titan III booster redirection.

Test Facilities: Arnold Center 16 foot Propulsion Wind Tunnel

[illegible] Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - The air vehicle performance, stability and control analysis.

Date Data Req'd: _____

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Performance, Stability and Control	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1-6 Responsible Company: Boeing

Test Title: GLIDER-STAGE II SEPARATION TEST (COLD FLOW)
(SPO APPROVED TEST #142)

Test Objective/Justification: The objectives of this test are two fold: (1) To provide data for analysis of the pressures and forces acting on the transition section and the booster during the events associated with glider escape and (2) to confirm or modify the analytical methods of predicting the pressures and forces encountered during escape for final staging.

CANCELLED - 2-22-62 due to Titan III booster redirection.

Test Articles/Outline: Complete Dyna-Soar model will be fabricated. Model is to provide passage for high pressure air into the simulated acceleration rocket nozzle in the transition section. A movable booster is to be sting mounted in its proper position aft of the glider-transition section. Movement required will be translation along the booster axis, from approximately 0.05" gap at the booster-transition separation plane to approximately 3.0" gap.

Test Facilities:
- Boeing Transonic Wind Tunnel
- Boeing Supersonic Wind Tunnel

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
															X			X					

EWA(s) No. 7-078

This Test Supports - The transition section development and the air vehicle performance, stability and control analysis

Date Data Req'd: 9-1-62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

1.6.1.8 AIR VEHICLE DESIGN - AIR VEHICLE PERFORMANCE - Aerothermodynamics	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2-1 Responsible Company: Boeing

Test Title: BOOSTER FLOW FIELD SURVEYS (SECOND STAGE VHEICLE)
(SPO APPROVED TEST #157) (COMPLETED)

Test Objective/Justification: Obtain heat transfer, pressure and flow field pictures required to define the flow characteristics with and without simulated second stage rocket exhaust.

COMPLETED

Test Articles/Outline: An existing model will be modified to provide flow through an annular opening at the base of the booster to simulate the rocket plume. Static pressure, total pressure and heat transfer rate distirubtions will be obtained at various angles of attack and Reynolds numbers with and without plumes. Shadowgraph and other photographic techniques, if necessary, will be used to define the plume shape.

Test Facilities: Arnold Center Tunnel "B"

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

Test Report

EWA(s) No. 7-117

This Test Supports - Data required to establish design data for the vehicle

Date Data Req'd: March 1962

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

2.1.1 HANDLING AND TRANSPORT EQUIPMENT

No design development testing is anticipated in this area.

R

2.1.2 SERVICING AND ENVIRONMENTAL EQUIPMENT-CRYOGENIC RECOOLER TEST	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: Boeing

Test Title: CRYOGENIC RECOOLER TEST

Test Objective/Justification: A recooler is required in the LH_2 ground servicing system to remove the transfer line heat inleak to the LH_2 and to subcool the liquid sufficiently to satisfy glider temperature delivery requirements.

Experimental data are required to

1. Obtain overall heat transfer coefficients, liquid and evaporated gas flow rates.
2. Verify the adequacy and safety of the recooler design.
3. Develop operating procedures and maintenance techniques.

Development testing is required to obtain reliable experimental data. Published heat transfer coefficients for boiling hydrogen are variable and depend upon a given installation. No boiling hydrogen heat exchanger of the capacity required for DS ground servicing requirements is known to exist.

Test Articles/Outline:

A prototype system consisting of a LH_2 dewar with supply lines for coolant and fluid to be cooled, a vacuum pump and necessary level controls and valves is required.

The LH_2 recooler will be tested in two phases: (a) Heat exchanger performance will be evaluated using LN_2 as the test fluid; (b) Confirm adequacy of the LH_2 recooler design with LH_2 as the test fluid.

Test Facilities: Tulalip Test Site and Mech. Prop. Lab.
The test facilities must have a capability of transferring the test fluid at flowrates up to 10 lb/min. at pressures up to 500 psia. Equipment is necessary to evacuate approximately 2 lb/min. of N_2 gas and 1 lb/min. H_2 gas at 4-6 psia.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-294

This Test Supports - Design and Drawing Release for LH_2 Recooler and support of LH_2 Servicing Develop. Tests

Date Data Req'd: 12-15-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

2.1.2 Servicing and Environmental Equipment - Hydrogen Disposal Systems	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: Boeing

Test Title: Hydrogen Disposal Systems Tests

Test Objective/Justification: During servicing and operation of the glider LH_2 systems the vented H_2 gas must be collected and conducted to a safe area for disposal. To develop and confirm safe operation of the disposal system, it is necessary to conduct evaluation tests on system components, (check valves, APU exhaust collector fitting, exhaust nozzle) and on the system design of the assembled components.

During ground launch countdown the glider APU's will exhaust directly to atmosphere after T-15 minutes. To determine if the exhaust might damage surrounding structure, umbilical lines, glider, etc., tests simulating APU's exhausting to atmosphere are required. Tests will determine if protection of the installation is required or if it is necessary to collect the exhaust to the time the cryogenic lines are disconnected.

Test Articles/Outline:

1. Check valves, exhaust nozzle, and APU exhaust collector fitting for evaluation testing.
2. A prototype disposal system consisting of piping, check valves, flexible hose, exhaust nozzle and APU exhaust collector fitting.
3. A setup simulating the glider in ground launch position with surrounding structure, APU exhaust, umbilical lines and boom.

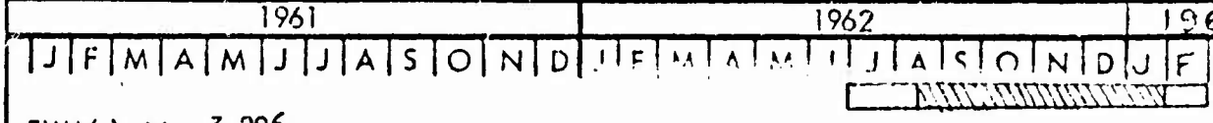
This disposal system, Item 2, will be tested by introducing hydrogen gas into the system and observing the effectiveness of the system to dispose of it.

The APU exhaust gas effect on surrounding structure will be determined by observing flame patterns of a simulated APU exhaust and monitoring temperatures of affected structure (Item 3).

Test Facilities:

Tulalip Cryogenic Test Facility
Mechanical Propulsion Laboratory

Schedule:



EWA(s) No. 3-296

This Test Supports - Design of vented hydrogen disposal systems

Date Data Req'd 12-15-63

Flow Time (EWA Rel. to Compl.) ____ Test Period ____

2.1.2 SERVICING & ENVIRONMENTAL EQUIPMENT - LN_2 & LO_2 Servicing Systems Dev. Tests	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: Boeing

Test Title: LN_2 & O_2 SERVICING SYSTEMS DEVELOPMENT TESTS

Test Objective/Justification: The glider nitrogen and oxygen supply tanks must be filled and topped with oxygen and liquid nitrogen at low variable flow rates and at pressures and densities with close tolerances. No existing system is known which satisfies the unique glider requirements. Although the ground servicing systems will consist substantially of existing components, pressure and temperature tolerances required by the glider are closer than can be predicted from available data on the equipment. Design development testing is required to obtain reliable design data.
The test program is being conducted to determine that the LN_2 and O_2 servicing systems can purge, cool down, fill, top-off, empty, control and monitor the glider nitrogen and oxygen systems as required. Specific test objectives are to:

1. Verify servicing system design concepts.
2. Develop operating techniques and maintenance procedures.
3. Determine ground system compatibility with glider tanks and plumbing.
4. Determine the existence of pressure surges in the servicing systems and eliminate them if necessary.

Test Articles/Outline:

A prototype servicing system consisting of a LN_2 supply cart, a high pressure supply of gaseous oxygen, a LN_2 pump, pressure controls, a LN_2-O_2 heat exchanger with temperature controls, transfer lines, glider quick disconnect fittings, instrumentation, control equipment and simulated glider tank, and prototype glider tank systems are required.

The ground servicing systems will be tested by servicing simulated glider tanks followed by servicing prototype glider tank systems. When servicing capability is adequately demonstrated, the ground servicing systems will be used to support the glider cryogenic systems development tests.

Test Facilities: Tulalip Cryogenic Test Facilities

Facilities are required for handling 500 gallons of LN_2 and 3500 pounds of CO_2 at 4000 PSIA

Schedule:

1961												1962												1963	
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-295

This Test Supports - DESIGN AND RELEASE OF LN_2LO_2 SERVICING SYSTEM AND SUPPORT OF GLIDER CRYOGENIC SYSTEMS DEVELOPMENT TEST

Date Data Req'd: 2-15-63

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

2.1.2 SERVICING & ENVIRONMENTAL EQUIPMENT - LH_2 Servicing System Dev. Tests	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: Boeing

Test Title: LH_2 SERVICING SYSTEM DEVELOPMENT TESTS

Test Objective/Justification: The glider hydrogen supply tank must be filled and topped with liquid hydrogen at low variable flow rates and at pressures and densities with close tolerances. No existing system is known which satisfies the unique glider requirements. Although the ground servicing systems will consist substantially of existing components, pressure and temperature tolerances required by the glider are closer than can be predicted from available data on the equipment. Design development testing is required to obtain reliable design data. The test program is being conducted to determine that the LH_2 servicing system can purge, cool-down, fill, top-off, empty, control and monitor the glider hydrogen system as required. Specific test objectives are to:

1. Verify servicing system design concepts.
2. Develop operating techniques and maintenance procedures.
3. Determine ground system compatibility with glider tanks and plumbing.
4. Determine the existence of pressure surge in the system and eliminate if necessary.

Test Articles/Outline:

A prototype servicing system consisting of LH_2 servicing unit, which includes a supply dewar, a pump, a heat exchanger and pressure controls, transfer line and valves, a recooler, a glider quick disconnect fitting and instrumentation and control equipment is required.

The ground servicing system will be tested by servicing a simulated glider tank followed by servicing a prototype glider tank system. When servicing capability is adequately demonstrated, the ground servicing system will be used to support the glider cryogenic system development test.

Test Facilities: Tulalip Cryogenic Test Facilities

Facilities are required for handling 1200 gallons LH_2 at flow rates up to 15 gal/min. and pressures up to 500 psia.

Schedule:

1961												1962												1963	
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-297

This Test Supports - Design and Release of LH_2 Servicing System and Support of Glider Cryogenic Systems Development Tests Date Data Req'd: 12-1-63

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

2.1.3 MAINTENANCE & TEST EQUIPMENT SEPARATION UNIT TESTER	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Cor The Boeing Co.

Test Title: **Breadboard Tests, Separation Unit Tester**

Test Objective/Justification:

The evaluation of preliminary (development) design of the separation unit (reference D2-6909-2, paragraph 1.3.8.2.2) bench test equipment can be accomplished only be extensive laboratory testing of the breadboard model of the bench test equipment. The tests will result in the required refinement of preliminary design configuration and will establish the suitability of the circuitry and component parts to be later incorporated in the final design of this test equipment.

DELETED- This test has been superseded by Test Brief 5, page 203.4

Test Articles/Outline:

A breadboard model of the separation unit test set will be fabricated and tested. This model will include a Squib simulating circuit. All output firing signals from the separation unit will be terminated in this simulator. The simulator will be tested for exhibiting actual Squib characteristics. The breadboard will be tested under glider power. The breadboard will have a self-check capability which must be compared with the flight hardware.

Test Facilities:

Existing Boeing electronic laboratory facilities are adequate for BTE breadboard testing.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-425

This Test Supports - Schematic Release and Functional Testing

Date Data Req'd: 15 April 62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

2.1.3 MAINTENANCE & TEST EQUIPMENT SEPARATION UNIT TESTER	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: The Boeing Company

Test Title: **Engineering Model Tests, Separation Unit Tester**

Test Objective/Justification:

The separation unit (reference D2-6909-2, paragraph 1.3.8.2.2) bench test equipment must be evaluated to determine the extent to which the design performance requirements are satisfied by the engineering design. Prior to release of the final design, the ability and performance of the test equipment to fulfill the flight hardware testing requirements must be determined. Inadequacies demonstrated in the Engineering Model Test program will allow design modifications to be incorporated in the model thus preventing redesign at a later stage in the program.

DELETED-Similar evaluation tests will be conducted on modified breadboard models.

Test Articles/Outline:

Tests on the engineering model will be conducted to determine the extent to which the test set simulates the actual glider loads on the separation unit. The accuracy in which the self-check capability operates will be determined. The input and output signal levels will be compared with those values encountered under flight conditions.

Test Facilities:

Existing Boeing electronic laboratory facilities are adequate for Engineering model testing.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-425

This Test Supports - Engineering Model Electrical Schematics and Parts List

Date Data Req'd: 15 Dec. 62

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

206

2.1.3 MAINTENANCE & TEST EQUIPMENT - SIGNAL CONVERTER TESTER	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: The Boeing Company

Test Title: **Breadboard Tests, Signal Converter Tester**

Test Objective/Justification:

Evaluation of preliminary (development) design of the signal converter (reference D2-6909-2, paragraph 1.3.8.3) test equipment can be accomplished only be extensive laboratory testing of the breadboard model of the bench test equipment. The testing will result in required refinement of preliminary design configuration and will establish the suitability of the circuitry and component parts to be later incorporated in the final design of this test equipment.

DELETED- This test has been superseded by Test Brief 5, page 203.4

Test Articles/Outline:

A breadboard model of the signal converter test set will be fabricated and tested. The BTE will simulate the serial, binary data output of the verdan model 31 computer to the (S/C) signal converter and present the equivalent loads to the S/C that it would encounter in actual operation. The BTE will test the S/C for proper signal-conversion and proper storage and read-out operations of the digital instruments.

Test Facilities:

Existing Boeing electronic laboratory facilities are adequate for BTE breadboard testing.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-426

This Test Supports - Schematic Release and Functional Tests

Date Data Req'd: 15 May 62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

2.1.3 MAINTENANCE & TEST EQUIPMENT - SIGNAL CONVERTER TESTER	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: The Boeing Company

Test Title: **Engineering Model Tests, Signal Converter Tester**

Test Objective/Justification:

The signal converter (reference D2-6909-2, paragraph 1.3.8.3) bench test equipment must be evaluated to determine the extent to which the design performance requirements are satisfied by the engineering design. Prior to release of the final design, the ability and performance of the test equipment to fulfill the flight hardware test requirements must be determined. Inadequacies demonstrated in the engineering model test program will allow design modifications to be incorporated in the model thus preventing redesign at a later stage in the program.

DELETED-Similar evaluation tests will be conducted on modified breadboard models.

Test Articles/Outline:

Tests on the engineering model will be conducted to determine the extent to which the test set simulated the actual glider loads on the signal converter. The accuracy with which the self-check capability operates will be determined. Input and output signal levels will be compared with those values encountered under flight conditions.

Test Facilities:

Existing Boeing electronic laboratory facilities are adequate for engineering model testing.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-426

This Test Supports - **Engineering Model Electrical Schematic Release and Parts List**

Date Data Req'd: **Jan. 10, '63**

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

2.1.3 BENCH TEST EQUIPMENT ELECTRICAL AND ELECTRONICS	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: Boeing

Test Title: Breadboard Model, Bench Test Equipment (BTE), Electrical and Electronic

Test Objective/Justification: The objective of this test program is to develop and test breadboard models of BTE which will be used for testing electrical and electronic glider hardware. The breadboards will be built through the joint efforts of an engineer-technician team to reflect preliminary design concepts. Testing of the breadboards will permit evaluation of the preliminary design and will result in the refinement necessary to meet design objectives.

The glider will include subassemblies of new design. The bench testing of these unique glider packages demands specialized test equipment involving new design concepts. Therefore, developmental testing of the BTE is essential to insure performance consistent with design specifications.

The breadboards constructed for the development program will serve a dual purpose. Since bench testing will require only one of each item of BTE, the same breadboard model which is used for development testing of BTE design can also be used to perform the functional testing of glider hardware.

Test Articles/Outline:

The test articles will be those items of electrical and electronic BTE listed below. A breadboard model of each item will be fabricated, tested, and reworked in order to achieve a suitable design. Each article of BTE will be tested to evaluate its ability to present simulated loads to, apply power to, insert stimuli in, and monitor outputs of a glider package.

1. BTE, Conv, Sig Data Card Assy
2. BTE, Conv, Sig Data Modules
3. BTE, Converter, Signal Data
4. BTE, Main Power Box
5. BTE, Programmer Separation
6. BTE, Rudder Pedal Assembly
7. BTE, Side Arm Control Assy
8. BTE, Subsys Elec Rel Pnl
9. DITMCO, Junction Cabinet
10. Power Supply, BTE, FCSE

Test Facilities: Existing Boeing Laboratory facilities are adequate for BTE breadboard testing.

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-425

This Test Supports - Dyna-Soar Airborne System Readiness Tests per D2-5697-16, Volume V

Date Data Req'd: 6-23-63

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

2.1.3 Bench Test Equipment Mechanical	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: The Boeing Company

Test Title: Breadboard Model, Bench Test Equipment (BTE), Mechanical

Test Objective/Justification: The objective of this test program is to develop and test breadboard models of BTE which will be used for testing mechanical glider hardware. The breadboards will be built through the joint efforts of an engineer-technician team to reflect preliminary design concepts. Testing of the breadboards will permit evaluation of the preliminary design and will result in the refinement necessary to meet design objectives.

The glider will include subassemblies of new design. The bench testing of these unique glider packages demands specialized test equipment involving new design concepts. Therefore, developmental testing of the BTE is essential to insure performance consistent with design specifications.

The breadboards constructed for the development program will serve a dual purpose. Since bench testing will require only one of each item of BTE, the same breadboard model which is used for development testing of BTE design can also be used to perform the functional testing of glider hardware.

Test Articles/Outline:

The development testing will be limited to those components and subassemblies of BTE which are of new and unique design. The list of mechanical BTE is not yet completely defined. Those items for which development testing is anticipated are:

BTE, Hydraulic
Simulator Ejec Seat
BTE, AP & GU (Mechanical Portion)

Test Facilities: Existing Boeing laboratory facilities are adequate for BTE breadboard testing.

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-426

This Test Supports - Dyna-Soar Airborne System Readiness Tests per D2-5696-16 Volume V

Date Data Req'd: 6-23-63

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

2.1.4 Ground Checkout Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company:

Test Title: Breadboard Tests

Test Objective/Justification: Laboratory testing and evaluation of breadboard models of portions of the GCOE is required. This breadboard testing is necessary to establish the design in those developmental areas where there is lack of certainty as to the equipment configuration which will best meet the performance requirements.

Test Articles/Outline: The following GCOE items will require breadboard testing to establish design:

1. Glider Test Set
   a) Flight Control
   b) Squib Simulator
2. RF Coupling and Distribution System
3. Card Punch Device
4. ARM Turbine Test Control Unit
5. Leakage Detector
6. Glider Suspension System
7. Servo Valve Controller

Test Facilities: Existing Boeing Electronic Laboratory facilities are adequate for GCOE breadboard testing.

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. 3-402

This Test Supports - Release of Design Data Packages to Cognizant Design Organizations

Date Data Req'd: 7-15-62

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

2.1.4 GROUND CHECKOUT EQUIPMENT

Test Briefs 2 and 3 and accompanying schedules (pages 205 through 215) have been deleted. The requirement for evaluation of "prototype" models will be met through engineering evaluation of end item hardware.

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 1 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Glider Servicing & Control Console (GSCC)

Test Objective/Justification:

During countdown the GSCC remotely controls the following: (1) monitors all glider cryogenic tank temperatures and flow rates, (2) monitors cryogenic fill line temperatures and pressures at the top of the umbilical tower, (3) indicates liquid presence at LH_2, LO_2 and fill and vent line service umbilical connectors, (4) indicates and controls the position of umbilical cables, and (5) controls all valves on the cryogenic servicing unit, and the cryogenic valves on the Glider.

The purpose of these tests is to provide an evaluation of the preliminary development design of the GSCC. As a result of these tests the circuitry will undergo necessary refinements to insure its suitability for servicing, controlling and monitoring the glider cryogenics and related systems. These tests will also verify the suitability of the GSCC to coordinate the required servicing functions as required.

Test Articles/Outline:

A breadboard model of the GSCC will be fabricated and tested. Testing will include, but not be limited to, the capability (1) to transmit the status indication of each of the systems being serviced and of the overall servicing operation to the Glider Launch Control Coordinator, (2) to transmit indication of critical temperatures, pressures, and rates of change to the Protective Monitor and Control Console, (3) through interface with the AFMTC Sequencer to accept timed function control, (4) to control all purging and filling of the cryogenic systems, and (5) to control and monitor the position of the electrical and servicing umbilical lines.

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

This Test Supports - RELEASE AND REVISIONS, DOCUMENT D2-50522, PACKAGING DESIGN REQUIREMENTS, GLIDER SERV. & CONT. CONS. Date Data Req'd: 5-14-62 [1]

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

[1] PLUS DOCUMENT REVISIONS TO 10-31-62

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 2 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Protective Monitor & Control Rack (PMCR)

Test Objective/Justification: The purpose of these tests is to collect information which will permit evaluation of the development design of the Protective Monitor and Control Rack. As a result of this testing, circuitry and component assemblies will be developed which will fulfill the operational requirements of the PMCR. The function of the PMCR is to control and coordinate the activities around the air vehicle, GSE and facilities so that personnel and/or equipment suffer no serious injury or impairment. Certain abnormal events will require immediate automatic action to avoid catastrophe. These events must be sensed and appropriate control exercised in order to keep damage to a minimum. The rack must also be capable of verifying that the launch complex area is returned to a safe condition after completion of an abnormal set of events following sensing of a malfunction.

The final design of a functionally operative PMCR can only be developed and proved by building a breadboard model of the rack, testing it, and changing the preliminary design as necessary.

Test Articles/Outline:

A breadboard model of the PMC rack will be fabricated and tested. Ability of the circuitry to relay status conditions to proper sources such as the Range Safety Officer and the Pad Safety Officer will be tested.

Status condition signals requiring testing include, but are not limited to, the following:

1. Fire Detection
2. Abnormal Pressures
3. Ordnance and Arming Devices
4. Hazardous Pilot Cabin Atmosphere
5. Hazardous Electrical Conditions
6. Discrete Signals

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

1961												1962												
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - RELEASE AND REVISIONS, DOCUMENT D2-50523, PACKAGING DESIGN REQ'TS, PROTECTIVE MONITOR & CONT. RACK Date Data Req'd: 4-20-62 1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

1 PLUS DOCUMENT REVISIONS TO 10-31-62

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Glider Test Conductor Console (GTCC)

Test Objective/Justification:

The purpose of these tests is to obtain information which will allow evaluation of the preliminary (development) design of the GTCC. The testing will result in required refinement of preliminary design configuration and will establish the suitability of the circuitry and component parts to be later incorporated in the final design of this console.

The GTCC contains provisions for centralized control and monitoring of detailed glider checkout, servicing and launch sequencing during all phases of launch complex operation. It must provide these control and monitor services for equipments and subsystems which are themselves newly developed. A functionally suitable GTCC can be attained only through extensive laboratory testing and evaluation of a breadboard model to obtain and prove satisfactory performance under all expected operating conditions.

Test Articles/Outline:

A breadboard model of the Glider Test Conductor Console will be fabricated and tested. Satisfactory voice communications or signal receipt, emission, reaction and response must be established between the GTCC and its interface equipments. The testing will include use of actual or simulated signals and evaluation of results in relation to equipment requirements for accuracy, stability, component tolerances, and other design parameters. The interfaces involved are as follows:

1. Flight Control Center
2. Master Control System
3. Glider Section
4. Servicing Control Console
5. Glider Launch Data Recorders
6. Protective Monitor & Control Rack
7. Glider GCOE

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities: Engineering Design Support Shop (2-4080)

Schedule:

1961												1962												
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - REVISIONS AND UPDATING D2-EO521, PACKAGING DESIGN REQUIREMENTS, GLIDER TEST CONDUCTOR CONSOLE Date Data Req'd: 3-1-62 ▷1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

▷1 PLUS DOCUMENT REVISIONS TO 10-31-62

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 4 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Simulators, Test Signal, LCE

Test Objective/Justification:

The Launch Control Equipment (LCE) is designed to be self-verifying. Signal simulation is required for those equipments which are not part of the LCE to provide this self-check feature. Signal simulators are therefore required to produce signals which during a countdown would normally be received from the Glider, the Ground Checkout Equipment, the Launch Complex Facilities and the Booster Launch Control and Monitor Equipment.

The purpose of these tests is to obtain information which will permit the evaluation of the development design of the Test Signal Simulators. The testing will result in refinement of the preliminary design configuration and will establish the capability of the simulators to support the checkout and test of Launch Control Equipment.

Test Articles/Outline:

Breadboard models of the Test Signal Simulators will be built and tested. Preliminary design of the simulators will be changed as necessary to provide appropriate terminating characteristics for those transmission lines originating from LCE interface equipments and to provide a means of signal insertion into the Launch Control Equipment as appropriate to permit self-verification tests. The Test Signal Simulators will consist of one rack and four or more suitcase-type portable units. The rack and each of the portable units will be mocked-up for testing.

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - RELEASE AND REVISIONS, D2-5052-6, PACKAGING DESIGN REQTS, TEST SIGNAL SIMULATORS. Date Data Req'd: 5-14-62 1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

FORM 2-6181-1-1 1 PLUS DOCUMENT REVISIONS TO 10-31-61

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 5 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Glider Launch Control Signal Conditioners and Amplifiers

Test Objective/Justification:

The purpose of these tests is to evaluate the preliminary (development) design of the signal conditioners. As a result of the tests the preliminary design configuration will be reviewed for refinement. The suitability of the circuitry and components to be incorporated in the final design will be established by these tests.

Signal conditioners preserve the fidelity of monitoring signals by eliminating or reducing the degrading effects of signal attenuation and distortion. These anomalies are due to transmission over long lengths of cable. Only by building breadboard models and testing under conditions similar to those at AFMTC can the development design of the signal conditioners be tried and proven so that final design will result in functionally suitable equipment.

Test Articles/Outline:

Breadboard models of the signal conditioners will be fabricated and tested. The following types of signal conditioners must be tested:

(a) cathode followers
(b) phase correction networks
(c) signal transformation networks
(d) wave shaping networks
(e) high and low pass filters
(f) impedance matching networks
(g) signal converters

Engineering analysis of signal problems which may arise as launch complex design nears completion may indicate the requirement for additional signal conditioners to those listed above.

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities:

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - RELEASE AND REVISIONS D2-80536, PACKAGING DESIGN REQ'TS, SIGNAL CONDITIONERS & AMPLIFIERS Date Data Req'd: 5-14-62 ▷1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▬

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 6 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Glider Launch Control Equipment, System

Test Objective/Justification:

The purpose of these tests is to test the ability of the prototype components of the Launch Control Equipment (LCE) to perform satisfactorily both individually and as a system.

Only by testing the entire LCE as a system can the ability of the individual components to perform satisfactorily when interconnected be verified.

Deleted - The requirement for system evaluation of prototype models will be met through engineering evaluation of end item hardware.

Test Articles/Outline:

The test articles will be prototype models of the following equipment:

Console, Glider Launch Coordinator
Console, Glider Servicing & Control
Cables, Glider Launch Control Interconnecting
Junction Boxes, Glider Launch Control
Simulators, Test Signal, LCE
Recorders, Glider Launch Data
Station, Pilot Monitor
Cables, Glider Launch, Umbilical
Console, Protective Monitor & Control
Rack, Glider Launch Control & Monitor
Signal Conditioners & Amplifiers, GLC
Harness, Set, Test LCE
Auxiliary Equipment, Blockhouse Glider Launch Control Equipment (System)

The testing will be accomplished to verify the ability of the equipment to perform individually and together as a system, and to render required changes as problems arise.

Test Facilities:

Engineering Design Support Shop

Schedule:

1961												1962												1963	
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343 — START PRS

This Test Supports - Configuration Development and Final Drawing Revisions and Release, Launch Control Equipment — Date Data Req'd: 4-5-63

Flow Time (EWA Rel. to Compl.) ☐ Test Period ▨

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 7 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Distribution Racks and Boxes, Glider Launch Control

Test Objective/Justification:

Racks and boxes are required to provide distribution points for transmission lines throughout the launch complex for power control, monitoring and data recording.

The purpose of these tests is to evaluate the preliminary design of the circuitry interconnections and terminal strip placement of the Distribution Racks and Boxes. These tests will establish the suitability of the junction box circuitry to perform as designed; they may show the need for revising layouts to provide a more orderly interconnection of the different items of equipment.

Test Articles/Outline:

The test articles will consist of mocked-up racks and boxes which will be used to interconnect the breadboard models of the Launch Control Equipment (where available) together with simulated signals from other equipment. One or more rack models will be built and one model box.

These articles will be energized to test for continuity, adequacy of insulation, resistances, cross-talk, radio frequency interference and other anticipated junction point problems as well as optimum junction box placement.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - REVISIONS AND UPDATING D2-BCS2.4, PACKAGING DESIGN REQUIREMENTS, DISTRIBUTION RACKS & BOXES Date Data Req'd: 3-13-62 ▷1

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▭

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 3 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Glider Launch Control Interconnecting and Umbilical Cables

Test Objective/Justification:

The purpose of the tests is to evaluate the preliminary design of the Glider Launch Control Cables to allow required refinement of preliminary design or configuration, and to collect information and data so that all preparations for final hardware design are complete. These cables are used to interconnect LCE, GCOE, Servicing Equipment, facilities, etc., to accommodate complete and co-ordinated over-all control and monitoring of the glider and the launch complex. The cables from individual equipment terminate at junction boxes and interconnections between equipments is made at the junction boxes. Cables are shielded and grounded as required to limit interference to an acceptable value. The equipments which these signals serve are newly designed. Unique electrical signal problems are sure to be encountered. Assembling and testing sample runs of these cables (complete for some and only partial for others) is mandatory to assure cable design which will result in satisfactory performance under all expected operating conditions.

Test Articles/Outline:

The test articles will be those cables (or portions thereof) which engineering analysis reveals must be tested for satisfactory transmission characteristics in mating, monitoring, controlling, or recording the equipments, signals, and events of a ground launch. Where testing is necessary, complete or partial cable runs will be made up, used for transmission, and tested for such expected problems as crosstalk, electronic interference, inductive and capacitive reactance and grounding and shielding problems and requirements. These cables will also be used to interconnect LCE breadboards and working models for LCE system-type testing.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

1961												1962												
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - RELEASE AND REVISIONS TO D2-80525, PACKAGING DESIGN REQUIREMENTS, INTERCONNECT & UMBILICAL CABLES Date Data Req'd: 5-1-62 ▷

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

▷ PLUS DOCUMENT REVISIONS TO 10-31-62

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 9 Responsible Company: The Boeing Company

Test Title: Design Development Testing, Glider Launch Data Recorders

Test Objective/Justification:

The purpose of these tests is to obtain information to evaluate the preliminary design of the Launch Data Recorder Equipment Group. Present design concept contemplates the use of commercial recorders. The circuitry and components electrically connected to these recorders must be tested for compatibility with the recorders and with the interfaces. Typical interfaces are the Protective Monitor and Control Rack, the Glider Servicing and Control Console, the Program Evaluator, and the glider GCOE. Typical measurements or functions which require recording include umbilical cable signals; voice coordinations; range and countdown time codes; cryogenic, pneumatic and hydraulic temperatures, pressures and flow rates; as well as status and control signals from GCOE and LCE consoles.

Test Articles/Outline:

The test articles will be:

1. Oscillographic and magnetic tape recorders. (These will be borrowed for test usage.)
2. Various signal sources to simulate launch complex signals.
3. Various types of signal conditioning equipment.
4. Simulated (for length and adjacent cabling) transmission cables.

The test plan will consist of feeding signals from models of Launch Control Equipment (where available) together with simulated signals from other equipment into recorders to assure that the required permanent usable data record is produced.

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

1961												1962											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F

EWA(s) No. 3-343

This Test Supports - REVISIONS TO D2-80528, PACKAGING DESIGN REQTS, GLIDER LAUNCH DATA RECORDERS

Date Data Req'd: 4-2-62 [1]

Flow Time (EWA Rel. to Compl.) ▭ Test Period ▨

[1] PLUS DOCUMENT REVISIONS TO 10-31-62

2.3.2.1 Launch Control Equipment	DESIGN DEVELOPMENT TEST PLAN	Brief No. 12 Responsible Company:

Test Title: Design Development Testing, Power and Function Control Rack

Test Objective/Justification:

The Power and Function Control Rack accomplishes function switching and power control during the launch countdown between LCE equipments and Ground Checkout Equipment. It also furnishes one or more carefully regulated low voltage, direct current power source(s) for use in conditioning extremely critical signals from cryogenics status transducers. The final design of this equipment can only be developed by building a breadboard model of the rack, testing it, and changing the preliminary design as necessary.

Test Articles/Outline:

The Power and Function Control Rack will be mocked-up and tested in the laboratory. The equipment will be tested to confirm the following capabilities:

1. Changing certain glider control functions, which will be received from the glider umbilical at AFMTC, from checkout mode to launch mode; this will involve switching controls between LCE and GCOE as necessary,
2. Controlling glider power and relaying power quality, circuit breaker position, and safe operation status information,
3. Providing special, carefully regulated, power sources as required.

Subsequent to breadboard development, the test article will be interconnected with other operational breadboards and simulators for LCE system testing.

Test Facilities:

Engineering Design Support Shop (2-4080)

Schedule:

▷ PLUS DOCUMENT REVISIONS TO 10-31-62

2.3.2.1 LAUNCH CONTROL EQUIPMENT	DESIGN DEVELOPMENT TEST PLAN	Brief No. 11 Responsible Company: The Boeing Company

Test Title: GLIDER UMBILICAL BOOM EVALUATION

Test Objective/Justification: The objectives of these tests are to verify the following:

1. That all umbilical lines and booms clear the vehicle take off envelope within the time allotted.
2. That the electrical boom and lines clear the glider abort envelope within the time allotted.
3. That all lines, booms, disconnect fittings, hydraulic actuators, snubbers and other equipment function properly without interference or failure during all boom operations.
4. That the effects of cryogenics in the lines do not introduce any undesirable characteristics during boom operations.

These tests are required because of the major role the boom operations perform during the final phases of the countdown. The boom design will involve erection and retraction mechanisms working in conjunction with the flexing of large, relatively stiff cryogenic and electrical lines. Adequate operation of the boom with resulting safety of the vehicle can only be assured by test. If these tests were not performed until after installation of the boom at the launch pad, any required revisions would delay the glider test program.

Test Articles/Outline:

1. Glider umbilical boom (the actual AGE item later installed at the pad)
2. Simulated umbilical tower (for mounting item 1)
3. Simulated glider (umbilical doors, fittings and affected skin surfaces)
4. Electrical and hydraulic power for boom operation
5. Liquid N_2 for cooling cryogenic lines
6. Liquid N_2 pump, lines, valves, fittings, etc., for item 5
7. Cryogenic umbilical lines (actual AGE or as close a simulation as possible)
8. Electrical umbilical lines (actual AGE or as close a simulation as possible)
9. Disconnect couplings

Test Facilities:

Mechanical Propulsion Lab

Schedule:

1962												1963											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

EWA(s) No. _____

This Test Supports - Shipment of Operational Boom to AFMTC

Date Data Req'd: 5-1-63

Flow Time (EWA Rel. to Compl.) _____ Test Period _____